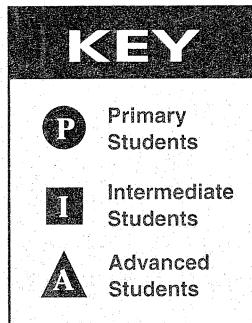




UNIT ONE: WHAT IS A TREE?

UNIT ONE DISCOVERIES

Students will be introduced to the parts of a tree and how they work together to keep the tree alive. For background see the Introduction and Chapter One in *Where Are All the Trees? A Minnesota Primer*.



To study something you must first identify it and then find it. Just what is a tree? *A Teachers' Guide to Arbor Month, 1990*, laid down some very simple guidelines. A tree is the largest of all plants and differs from other plants in four ways:

1. Most trees grow at least 15 to 20 feet tall.
2. They have one woody stem that is called a trunk.
3. The trunk grows at least 3 to 4 inches thick.
4. A tree's trunk can stand by itself.

No other plant has all four of these traits. Now that you know WHAT you are looking for, let's go out and find one.

Activity 1: Meeting the Neighbors!

P I A

All ages, any time or any season, can explore and enjoy the yard, the block, the neighborhood park as they get to know their leafy neighbors. Pack a lunch, open the door, and let's explore!

Editor's note: Every time you take the children outside, stress the need to be "Good Naturalists." Always leave your place the way you found it.

Preview an area for safety and identification of available species. Bring the children to it and just let them SENSE. What's big, little, tall, short? What color are the trees? What shape are they? What does their skin (bark) feel like? For the younger ones, make it a spyglass walk (make spyglasses out of construction paper or a toilet paper roll). Have them lie down and look up, roll over, and look down.

VARIATIONS

Tree Seek and Find

Pair off children and blindfold one partner. Have the other take him or her to a tree to explore it. How long did it take to get there? How fat is the tree? What does the bark feel like? Can you reach branches? Take blindfolded partners back to the starting place a different way, remove their blindfolds, and see if they can find "their" trees. Repeat for other partners.

Used with permission from Joseph Cornell, Sharing Nature with Children.

Silent Walk

Organize a group and stress that there will be no talking during the hike—just the use of silent hand signals to point out interesting things along the way. Agree upon simple signals (arm raised for “stop,” etc.). Off you go for a very quiet exploration.

Blindfolded Walk or Trust Walk

(Probably not suited for a younger group. Try a Silent Sit instead—see next activity.)

To establish a keener awareness of the other senses (hearing, smell, touch), blindfold the participants and lead them through an area. All are silent except the leader who quietly and safely guides them, pointing out things to listen to, smell, or touch. As a variation, take them back unblinded along the same way so that they can see what their other senses had explored.

Silent Sit

Assign children places to sit quietly in the chosen area. Have them put their heads in their laps or close eyes and “explore” with their ears, noses, and hands. *

Activity 2: Adopt a Tree

P

As a group (or individually if there are enough trees available), adopt a tree to get to know and observe as time goes by. Try to have someone adopt an evergreen so that the differences between it and deciduous trees can be noted. Remember to always stress the “Good Naturalist” rules when outside. This activity helps the children come to understand the tree as another living thing that can be helped or harmed by them.

L A

Vary this activity for older children by making observation the key—add a journal to record the data. Depending on the age, help the children identify their tree and note shape, size, leaf structure, injuries, branch and twig shapes, changes with the seasons, animal inhabitants, etc. You are helping them make a friend for life. *

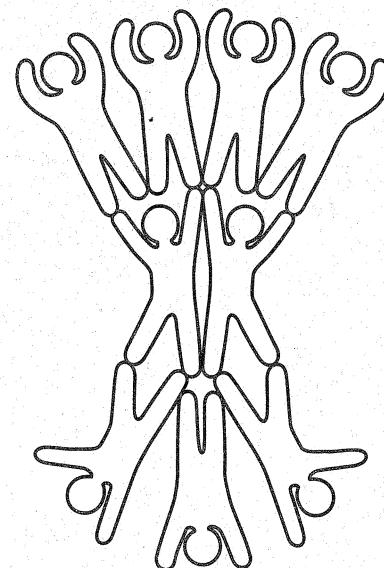
Activity 3: Let's Build a Human Tree!

P

Tell the children that they are going to learn about a tree by becoming the different parts.

Assign the basic parts to the children in the following ratios: 2: trunk, 3: roots, 4 or more: crown.

Following the diagram, lay the two “trunk” parts side by side with arms extended up to make the branches. Lay the three “root systems” feet to feet at the base of the trunk. Have their arms extended out to form the lateral roots. Finally, lay the “crown” among the branches with arms encircled to form the crown.



Make a forest with more children or smaller saplings with fewer.

You can also make different seasons: children who are "crowns" are gone in winter, have arms pulled in for spring, and slowly unfold for summer; for fall, "crown" children can drop and lie on the forest floor around the trunk or fly away. Or add sound effects: "roots" can "slurp, slurp" as they wiggle fingers; "trunks" can say "stretch" as they reach up; "crown" can "swish" as they wave arms.

Older students can act out and verbalize the function of each layer of the trunk and root system. Intermediate ages seem to enjoy the play and vocalizations. Using the activity to visually dramatize various things that can happen to the tree seems to work better with the older students.

Make name cards in the following numbers using the sample sheets included at the end of this unit.

1	heartwood
1	taproot
3	lateral roots
4	sapwood
4-6	cambium
6-8	phloem
6-10	bark (or as many as needed for all to participate)
1	bug
1	lawn mower
1	woodpecker

Cards can be punched and attached to string so they can be worn around the neck. Have students select a card and stand in a circle. As you assemble the tree, explain briefly to each part what it is doing to help the tree.

Ask the **heartwood** to come to the center.

Leader: "This is the heartwood—the inner core, the strength of the tree. The heartwood's job is to hold the trunk and branches upright so the leaves can get their share of the sun. The heartwood has been around a long time—so long that it's dead. But it's well preserved! The heartwood used to be alive, but its thousands of little tubes that carried water up and down are now all clogged with resin and pitch."

Have students say, "I stand tall."

Student who is heartwood will repeat.

Ask the **taproot** to sit at the base of the heartwood, facing outward.



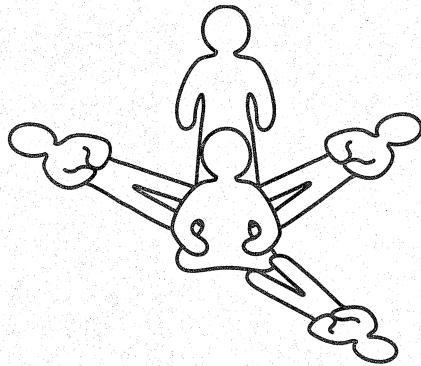
Leader: "You are a very long root, called a taproot. Plant yourself deep in the ground—about 30 feet. The taproot enables the tree to get water from deep in the earth, and also anchors the tree firmly to the ground. When storms come, the taproot keeps the tree from being blown over by high winds."

Have students say, "I anchor."

Student who is the taproot will repeat.

Then have heartwood say, "I stand tall" and taproot say, "I anchor."

Ask the three **lateral roots** to lie on their backs with their feet up against the tree and bodies extending away from the tree.

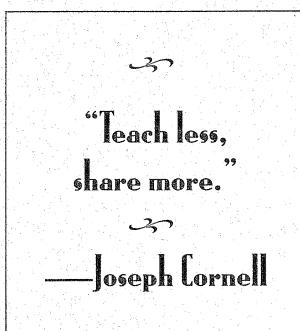


Leader: "You are the lateral roots. There are hundreds and hundreds of you. You grow outward all around the tree, like branches but underground. You also help hold the tree upright. At your tips are tiny root hairs.

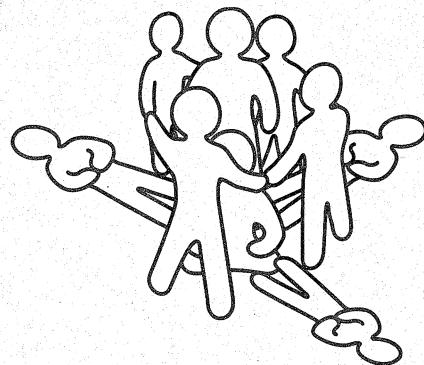
"Trees have thousands of miles of root hairs that cover every square inch of soil into which they grow. When they sense that there is water nearby, the cells grow toward it and suck it up. The tips of the root hairs have cells as tough as football helmets. I want the lateral roots to wiggle their fingers and practice slurping up water."

Have students say, "slurp, slurp." Students that are lateral roots will say, "slurp, slurp."

Then have the heartwood say, "I stand tall," the taproot say, "I anchor," and the lateral roots say, "slurp, slurp."



Ask the four **sapwoods** to form a complete circle around the heartwood, facing the heartwood. Have them hold hands and be careful not to step on any roots.



Leader: "You are the part of the tree called the sapwood, or xylem. You draw water up from the roots and lift it to the tree's highest branches. You are the most efficient pump in the world, with no moving parts. You're able to lift hundreds of gallons of water a day, and you do this at speeds of more than 100 miles an hour! After the roots slurp the water from the ground, your job is to bring the water up the tree."

Students that are the sapwood will do a pumping up action while saying, "We pump, we pump."

Then have the heartwood say, "I stand tall," the taproot say, "I anchor," the lateral roots say, "slurp, slurp," and the sapwood say, "we pump, we pump."

Have the **cambiums** form a circle around the sapwood, also facing inward and holding hands.

Leader: "Toward the inside of the tree is the cambium layer, the growing part of the tree. Its job is to make the trunk, branches, and roots grow thicker. Every year it adds a new layer to the sapwood and phloem."

The students that are the cambium will say, "We make new cells."

Then have the heartwood say, "I stand tall," the taproot say, "I anchor," the lateral

roots say, "slurp, slurp," the sapwood say, "we pump, we pump," and the cambium say, "we make new cells."

Next have the **phloem** join hands and form a larger circle around the cambium.

Leader: "The phloem has tiny pipelines. The food made by the leaves moves through the phloem to other parts of the tree. This food is 'sap.'"

Have the phloem pretend they are transporting food down from the leaves by starting out holding their arms above their heads, then lowering them and raising them again.

The students that are phloem say, "We bring sap around, we bring sap around."

Then have the heartwood say, "I stand tall," the taproot say, I anchor," the lateral roots say, "slurp, slurp," the sapwood say, "we pump, we pump," the cambium say, "we make new cells," and the phloem say, "we bring sap around, we bring sap around."

Ask all of the remaining students to be the **bark**. Have them circle the tree, facing outward. They hold hands and ward off enemies.

Have them say, "we protect, we protect."

Describe different events that can happen to the tree: fire, bark being peeled off, roots being damaged, holes being drilled, branches falling off, etc. Have participants react to what is happening. Introduce the **bug**, the **lawn mower**, and then the **woodpecker**. When the bug is introduced, the bark will be able to stop the bug from entering the tree until the tree is damaged by the lawn mower. The bug will enter where the lawn mower hit the tree. Once inside, the bug can move freely under the bark but no deeper. The woodpecker is then sent to "get the bug."

While you are going around the tree, lead the rest of the tree groups in their parts. Shout the commands for all the parts in sequence. Go through the sequence three or four times.

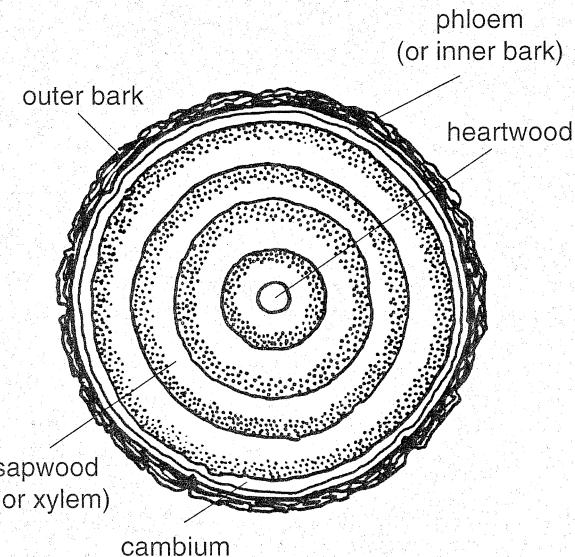
When you finish, have the students give themselves a big hand for being such a wonderful tree. And help the roots up off the ground! ☺

Adapted with permission from Joseph Cornell, Sharing the Joy of Nature.

Activity 4: Learn Those Layers

I A

Can you label each layer? The layers you're looking for are: outer bark, heartwood, phloem (or inner bark), cambium, and sapwood. Use Activity Sheet 1A—Learn those layers! ☺



THE SUM OF THE PARTS EQUALS THE WHOLE!

These last three activities provide opportunities for more detailed study of the various parts of the tree. Use your nature walks to pick up leaves, twigs, cones, seeds, again always making sure that the areas are safe. Each neighborhood will be unique, and the material you collect will serve to personalize your particular study with the children. Continue to stress the need to be "Good Naturalists" and to stay on the trails or in the safe areas. Use the collected materials to provide learning opportunities back at home (or the classroom) and for the art projects listed later in this section.

ity to introduce the children to the Minnesota species that are not familiar to the area they live in. Use the pictures provided in Unit Four to help them become familiar with their state's treasures. Play the same match games, adding a new species each time.

I

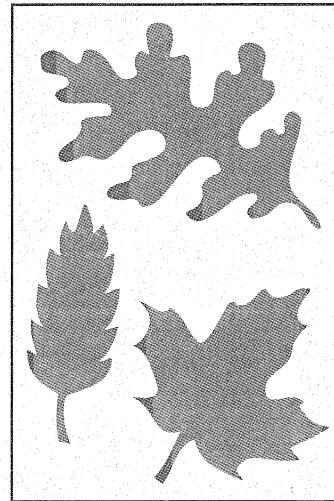
Collect leaves and allow the children time to look at the leaves and become familiar with their characteristics. Take them back outside for a Leaf Relay Game. Divide everyone into teams and give each child a leaf. On "go," have one child from each team race to find the tree the leaf is from. The first team that has all its players find their trees wins. Have the children take the leaves and press them between layers of newspaper to dry them out. Then help them make a simple leaf collection of their new friends and neighbors.

Activity 5: Leaf it Up!

Any walk or outdoor time is a great time to collect specimens: leaves, twigs, branches, seeds, pine cones. As much as possible encourage the children to pick up what has already fallen from the trees.

B

Prepare ahead of time construction paper cutouts of the leaves from your yard or area. Tape them up around the room the day of your hike. When the children return with their leaves, spend some time talking about them. What shape are they? What color and size? How do they feel? Then give a leaf to a child and tell him or her to go on a treasure hunt and find the match in the room somewhere. Give each child a turn. Put all the leaves in the middle and have the children sort them back out again (by size, color, or shape—whatever category you choose). Each game will reinforce their identification skills. Use this activi-



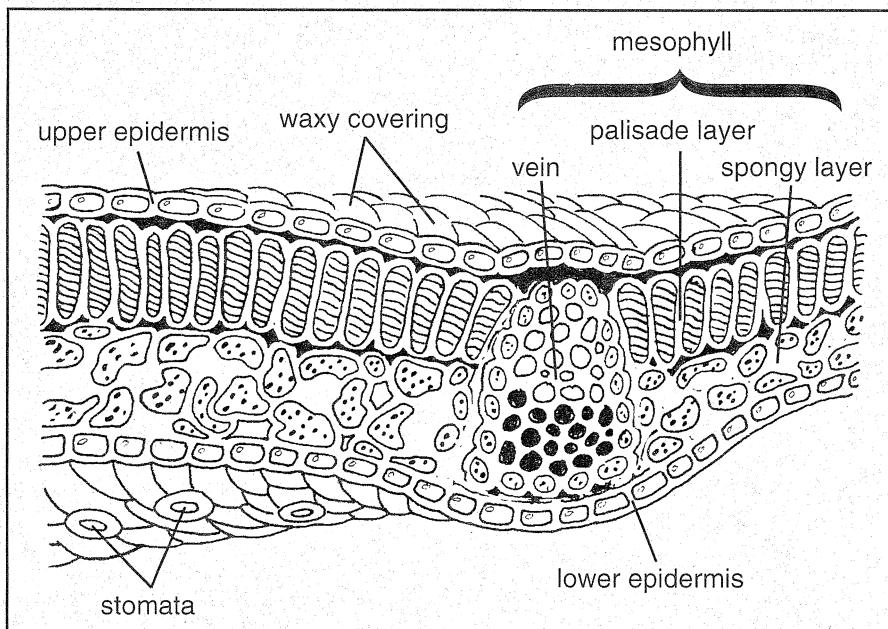
A

Leaves play a crucial role not only in the life of the tree, but also in our lives. They are the food manufacturing factories for the whole organism, using sunlight, water, and carbon dioxide to make glucose, a sugar. This incredible process is called photosynthesis,

and when it happens, the tree releases oxygen into the air as a by-product—oxygen we can breathe! Go over the following description of a leaf to help the students understand the complexity of this remarkable “living machine.” Then with the help of a little kitchen magic, construct an edible leaf and dine, compliments of the neighbors.

Upper and Lower Epidermis: These two layers make up the protective “skin” of a leaf. They let in light and are usually coated with a waxy covering that reduces water loss. Stomata, tiny holes that open and close to let in carbon dioxide and release oxygen, are part of a leaf’s epidermal layers. (Most stomata are found in the lower epidermis. A single leaf can have more than a million!)

Mesophyll (Ground Layer): This middle layer of the leaf is made up of several other layers. The spongy layer contains loosely packed, differently shaped cells. Gases that take part in photosynthesis pass into this layer through a leaf’s stomata. Some cells in the spongy layer have chloroplasts that contain chlorophyll, the pigment that absorbs light energy to power photosynthesis.



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The palisade layer contains many chloroplasts in its cells. Most of the reactions in photosynthesis occur in this layer.

The veins branch out to almost every cell in a leaf. They bring water and minerals to the leaf cells and carry sugar out of the leaf.

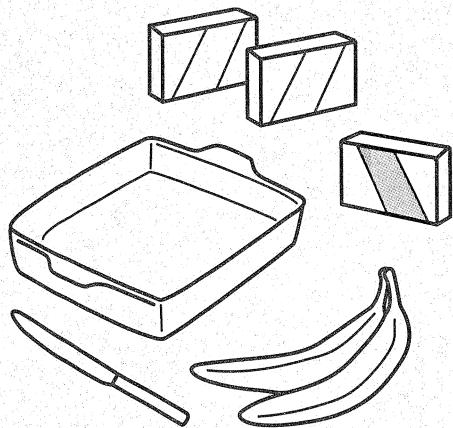
Once you’ve discussed the layers of a leaf, have the kids make a couple of edible leaf models by following the directions provided on the next page. To give the kids an idea of where each layer in a leaf is located and how the layers fit together, talk about the gelatin models and the layers represented in them before serving them to the kids. (Once the gelatin models are cut, the layers will tend to mix together.)

Point out in the gelatin models the upper and lower epidermal layers (green gelatin), the stomata (bananas), the mesophyll (yellow gelatin), the spongy layer (cantaloupe), the palisade layer (grapes), the vein (strawberries), and the leaf’s protective waxy cuticle (whipped cream). (In an actual leaf, the waxy cuticle covers both the upper and lower epidermis.) Also ask the kids which of the kinds of fruit in the models represent layers in the leaf that would contain chloroplasts

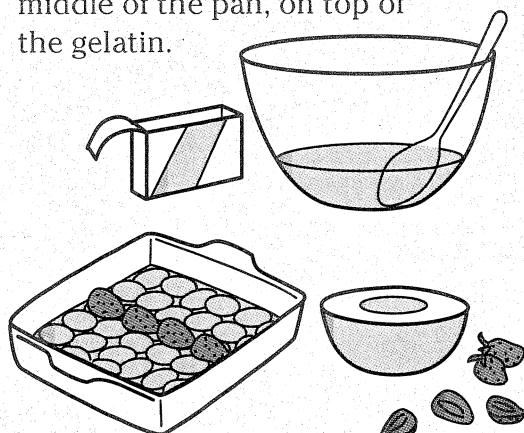
(grapes and cantaloupe). Then let the kids munch on their edible leaves!

How to Make Edible Leaves

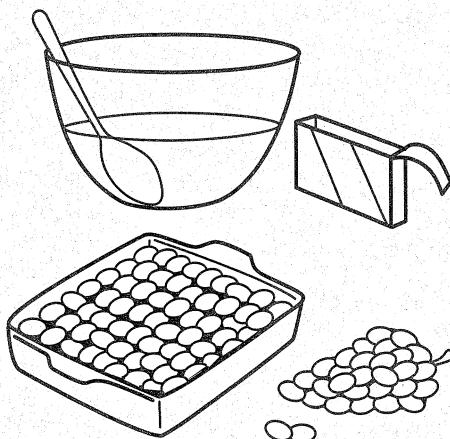
1. For each 8 x 8 inch (20 x 20 centimeter) glass pan you'll need two packets of yellow gelatin and one packet of green gelatin. You can substitute different types of fruit if the ones we suggest are out of season.
2. Cut a banana into 1/4 inch (6 millimeter) slices and scatter them over the bottom of the pan.



3. Mix the green gelatin according to the directions on the gelatin box. Before chilling the gelatin, pour just enough of it into the pan to cover the bananas. Save the leftover gelatin and keep it at room temperature.
4. Cool the banana and gelatin mixture in a refrigerator or freezer until the gelatin is firm. (It will take about one hour to firm up in the refrigerator and about 30 minutes or less in a freezer.)
5. Make a row of strawberries down the middle of the pan, on top of the gelatin.



6. Scoop out small chunks of cantaloupe and cover the cooled layer with them.
7. Mix one package of yellow gelatin, then pour it over the strawberries and cantaloupe. Cool the mixture until the yellow layer is firm.
8. Arrange the grapes side by side in rows across the yellow layer.



9. Mix the second package of yellow gelatin and pour it over the grapes, then cool the mixture until this newest layer is firm.
10. Pour the remainder of the green gelatin into the container, and cool the mixture one last time.
11. Spread a thin layer of whipped cream over the final layer of green gelatin. *

Editor's note: After your kids have created and eaten their leafy "food factories," they can take a microscopic look at the cross section of a leaf. You can order slides of leaf cross sections by writing to Carolina Biological Supply at either 2700 York Road, Burlington, NC 27215, or at Box 187, Gladstone, OR 97027. Or you can call 800-334-5551. (You can also check with your local junior or senior high school science department.)

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Activity 6: Rally Round the Roots

P

On your explore walks, take time to look down. Many trees have huge surface roots that can be followed out from the trunk. They appear and disappear on their search for water. Remind the children not to disturb them—they are living tissue doing the important job of holding the tree up and looking for water. Very carefully remove soil, if possible, to take a peek at the smaller roots underground. Remember to cover them up when you are through.

D A

Tree root expert Thomas Perry tells us how to examine tree roots. Most of the small absorbing roots of trees are in the forest litter layer and top inches of the soil. They are often smaller than the lead in a pencil. To easily expose them, carefully sweep away surface litter and soil with fingers and dig gently with a sharp stick or fork. These small roots are constantly growing, dying, and regrowing throughout the season, and can be examined with the eye or a hand magnifying glass. A healthy root tip usually has a creamy white, pink, or light tan interior and will snap like a fresh garden bean. It has a pleasant odor that can be masked by the odor of good clean earth. Unhealthy root tips are limp and dull in color, and sometimes stained blue or black by disease fungi. They will often smell of rotting things.

Dig (gently please) more deeply into the soil, and you'll see that most of the fine roots have grown upward into the surface layers of soil from larger roots that grow horizontally. These horizontal roots are usually located four to 11 inches below the surface.

To look at roots in a grassy lawn, go about 15 feet from the trunk of the tree and cut a square area through the sod with a sharp

spade or trowel. Gently peel back the sod. You will see both the tree roots and the grass roots intermingled in the surface inches of the soil. When you're done, just pat the sod down carefully and water several days.

Used with permission from A Teachers' Guide to Arbor Month, Minnesota Arbor Month Partnership, 1990.

VARIATIONS

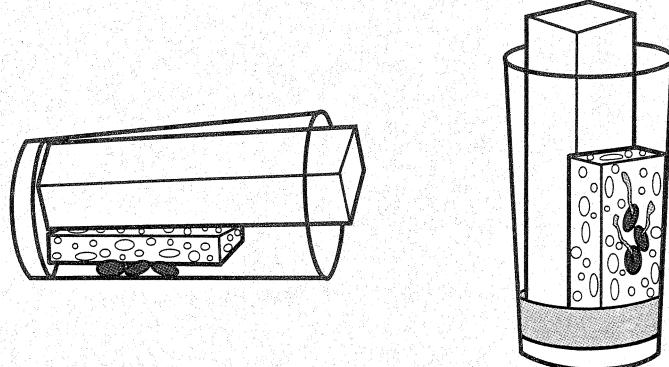
A Closer Look

To get an even better look at roots, experiment with growing seeds back home (or in the classroom). Place a damp sponge on a plate and sprinkle with radish or zinnia seeds. Keep moist and examine the seeds to see the root hairs as they grow.

Reprinted with permission of G. P. Putnam's Sons from Experimenting with Seeds and Plants, Ware Budlong and Mark H. Fleitzer, ©1970.

Sponge Sprout

Place bean or corn seeds against the side of an empty glass lying on its side. Hold in place with a wet sponge that is supported by a block of wood or anything that will keep it along the side.



Keep an inch of water in the bottom to keep the sponge wet, and watch the seeds sprout. ♀

Activity 7: Bark Up a Tree



Make a cast of bark by pressing clay firmly against a tree. Gently remove and place face up in a shoe box. Mix 2 cups of plaster of paris with enough water to make a thick, creamy mix. Pour over clay and set aside until hard (usually several hours). When hard, strip away box and clay. Do several and use them for a match game back outside to see if the children can identify the trees they came from. ☺

Used with permission from Seymour Simon, Trees on Your Street.

“I like trees because
they seem more
resigned to the way
they have to live than
other things do.”

—Willa Cather
Pioneer

ARTS AND CRAFTS

LET'S BUILD A TREE

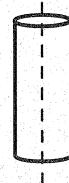
Use the simple patterns on Activity Sheets 1B and 1C. Have the children color, cut, and then paste the trunk, roots and crown onto a big piece of construction paper. They can add grass, sun, animals, birds, etc., to complete the scene.

3-D TREES

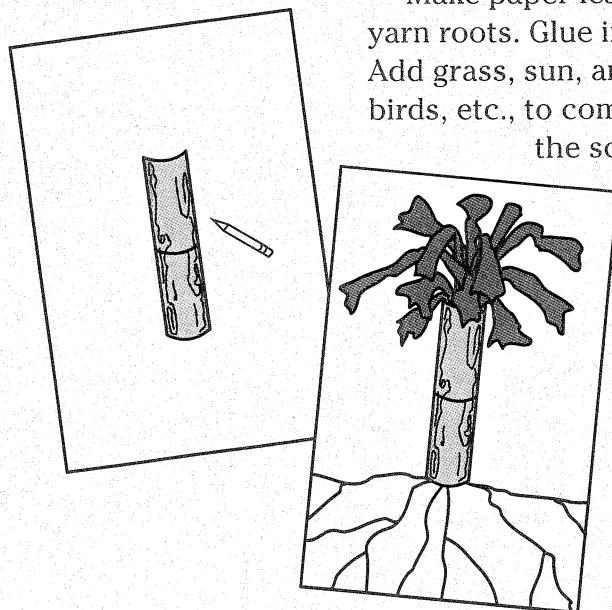
Gather together a large piece of construction paper, a toilet paper tube or a paper towel tube (this will make a larger tree), green tissue paper, scissors, markers, crayons, yarn, glue, and tape. Following the directions below, construct a three-dimensional tree.

For your trunk, cut each tube in half, vertically. Make both halves the same size. Use markers or crayons to make knotholes on the pieces.

Tape your halves end-to-end on your large piece of construction paper. Leave room for your crowns and roots!



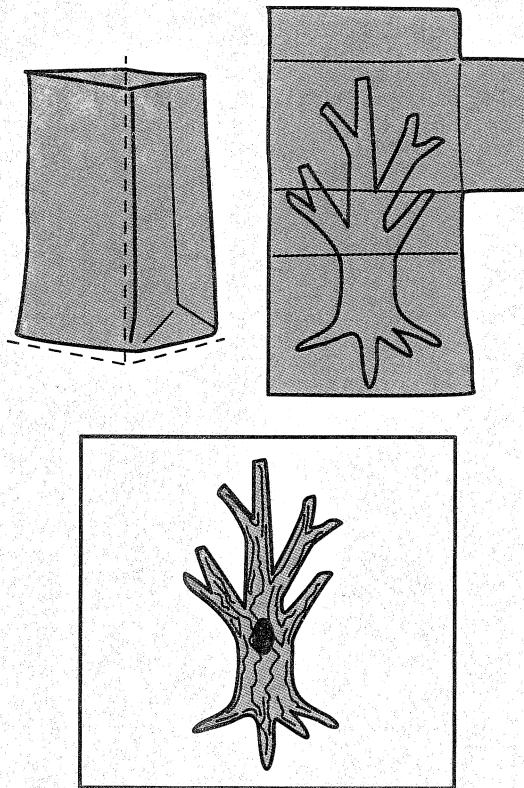
Make paper leaves and yarn roots. Glue in place. Add grass, sun, animals, birds, etc., to complete the scene.



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TEXTURED TREES

Open a paper bag (large, medium, or small—depending on the size of the tree you want to construct) and lay flat. Draw the roots, trunk, and branches similar to the following diagram or in your own design:



Add features by coloring in (one suggestion is to draw lines, bark contours, and wildlife holes with a dark marker and then overlay it all with different shades of brown crayons). Cut out and then crumple to give texture. Open up and paste or tape edges down on a piece of construction paper or tag board. (You can “stuff” the inside of the tree to give it more depth.)

Depending on the colors and paper used, many different textured barks can be simulated. This is an excellent discussion starter on the variety of trees that exist and how unique they are, even by the color of their “skins.”

Used with permission from Deb Murphy.

BACKYARD MONSTERS!

Gather paper, crayons, scissors, glue, and a sack full of the items you have collected on your nature walks. Turn the imaginations loose and create your own “critters.”

Have the children describe them, name them, tell about what they eat and where they live. Then hold an awards ceremony for all of the new creations: the greenest, shortest, tallest, smallest, fiercest, most bashful, etc. All are winners.

LEAF RUBBINGS

Place one leaf at a time under a piece of lightweight construction or typing paper. Show the children how to use the side of a crayon (one of the only times they can delightfully take the paper off of the crayons and get away with it!) to rub out the outline of the leaf underneath. Repeat the process by changing leaves and colors to cover the paper with dramatic effect.

SUN CATCHERS

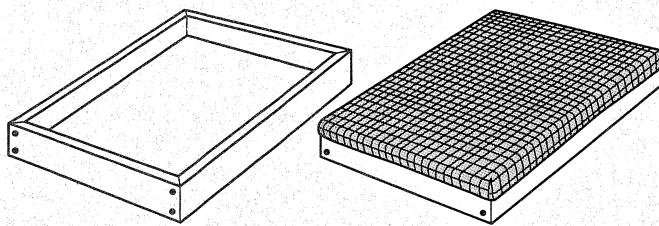
Place gathered leaves on a piece of waxed paper cut to desired size. Use a grater or potato peeler to shave crayon bits and scatter around the leaves. (An equally dramatic effect is to sprinkle glitter on the waxed paper.) Place another piece of waxed paper of equal size on top. Cover with a piece of newspaper and iron with a warm iron. (Depending on the age of the children, this should be supervised or performed only by adults.) Attach a string and hang in the sunshine.

SUN PRINTS

Purchase a solargraphics kit at a nature supply store. Place objects on the special paper, cover with plexiglass, and then expose to the sunlight until the original blue paper turns white. Remove everything and submerge the paper into a shallow dish of water. It will return to its original blue color everywhere except where the leaves were placed; those areas will now be white. The resulting pictures can be very dramatic.

SPLATTER PRINTS

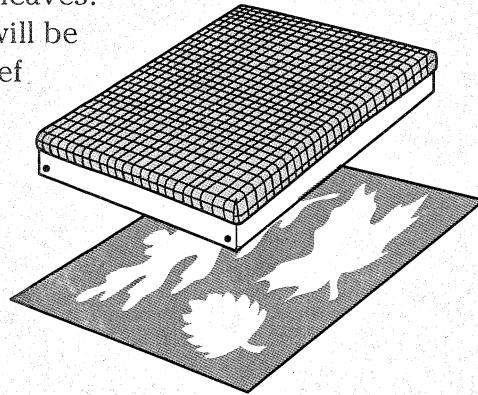
Construct a simple box and attach a piece of screen over it.



Cover working area with newspaper or an old plastic cloth. Place a piece of paper under the screen assembly with your leaf arrangement on it. Using a toothbrush or small paint brush, dip into desired tempera paints and scrape brush over the screen so that the paint is splattered on the paper underneath. (Make sure the children have on old clothes or paint shirts for this one!)

Remove the screen and take off the leaves.

The result will be a lovely relief picture of the leaves. (Use more than one color or add glitter for a dramatic effect.)



NATURE COLLAGES

To twigs, leaves, seeds, etc., add markers, color crayons, fabric paints, Elmer's colored glues, water paint. Put on the aprons, pass out the paper, and watch the magic happen.

Any age responds to the beat and rhythm of music, whether listening to it or making it. Try some of the following series for background music during your art activities, guided imagery stories for quiet times, or just beautiful listening.

- Mannheim Steamroller: Any of the Fresh Aire Series.
- Mannheim Steamroller: Yellowstone, The Music of Nature.
- Solitudes: Any of the series. Some combine music with nature sounds. Others are all natural and from different settings (lake, stream, forest, seashore).

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The following resources are all children's books. They are marked loosely with a P (Primary), I (Intermediate), or A (Advanced) after each entry to indicate a general level of the information presented. As stated before, any of them are useful at any level because of the easy access to information they present.

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Heartwood

“I stand tall”

Taproot

“I anchor”

Lateral roots

“slurp, slurp”

Sapwood

“we pump, we pump”

Cambium

“we make new cells”

Phloem

“we bring sap around”

Bark

“we protect, we protect”

Bug

“chomp, chomp”

Lawn mower

“varoom, varoom”

Woodpecker

“get the bug”

ACTIVITY SHEET 1A

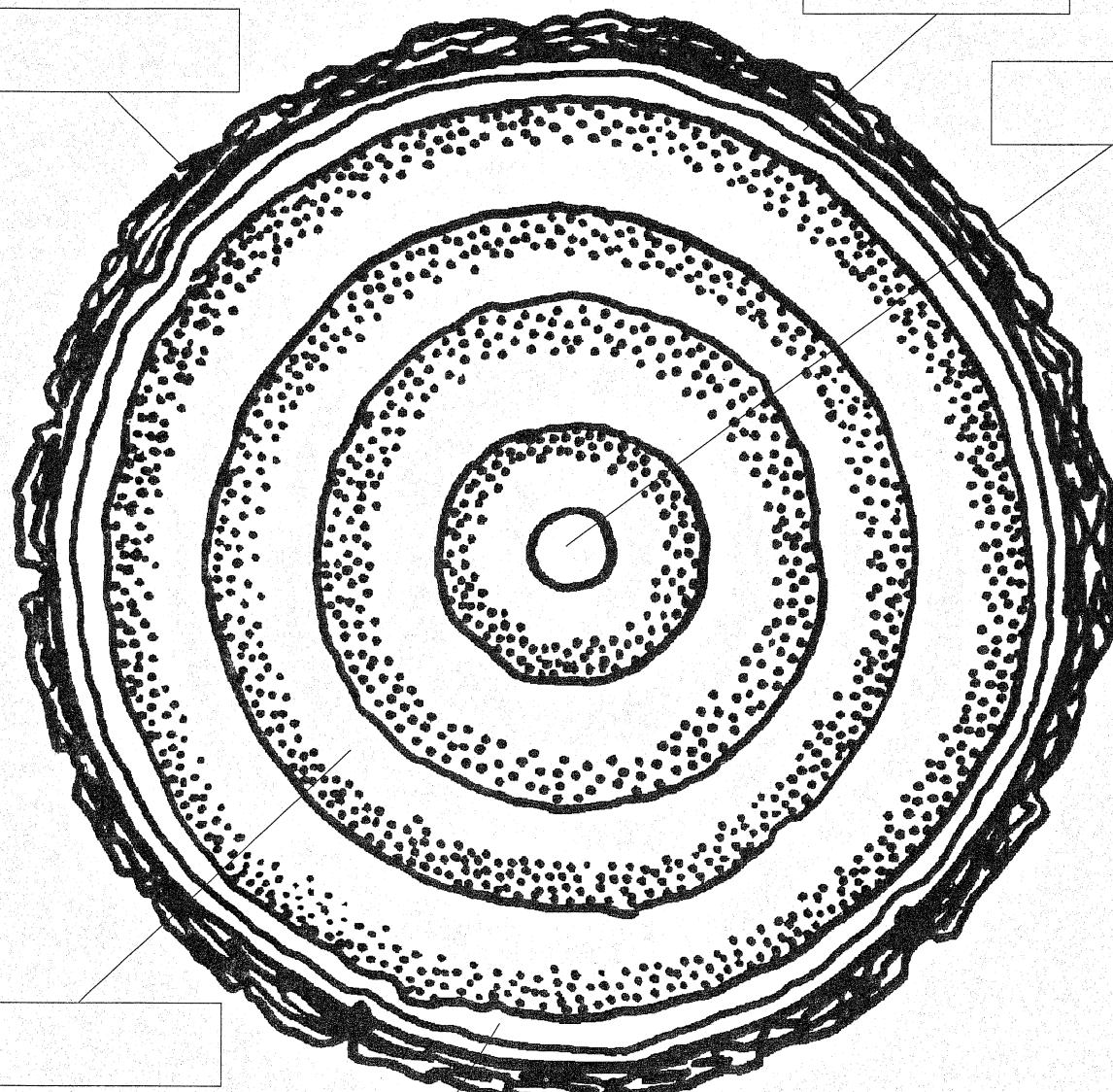
LEARN THOSE LAYERS

Can you label each layer? The layers you're looking for are:

outer bark
cambium

heartwood
sapwood (or xylem)

phloem (or inner bark)

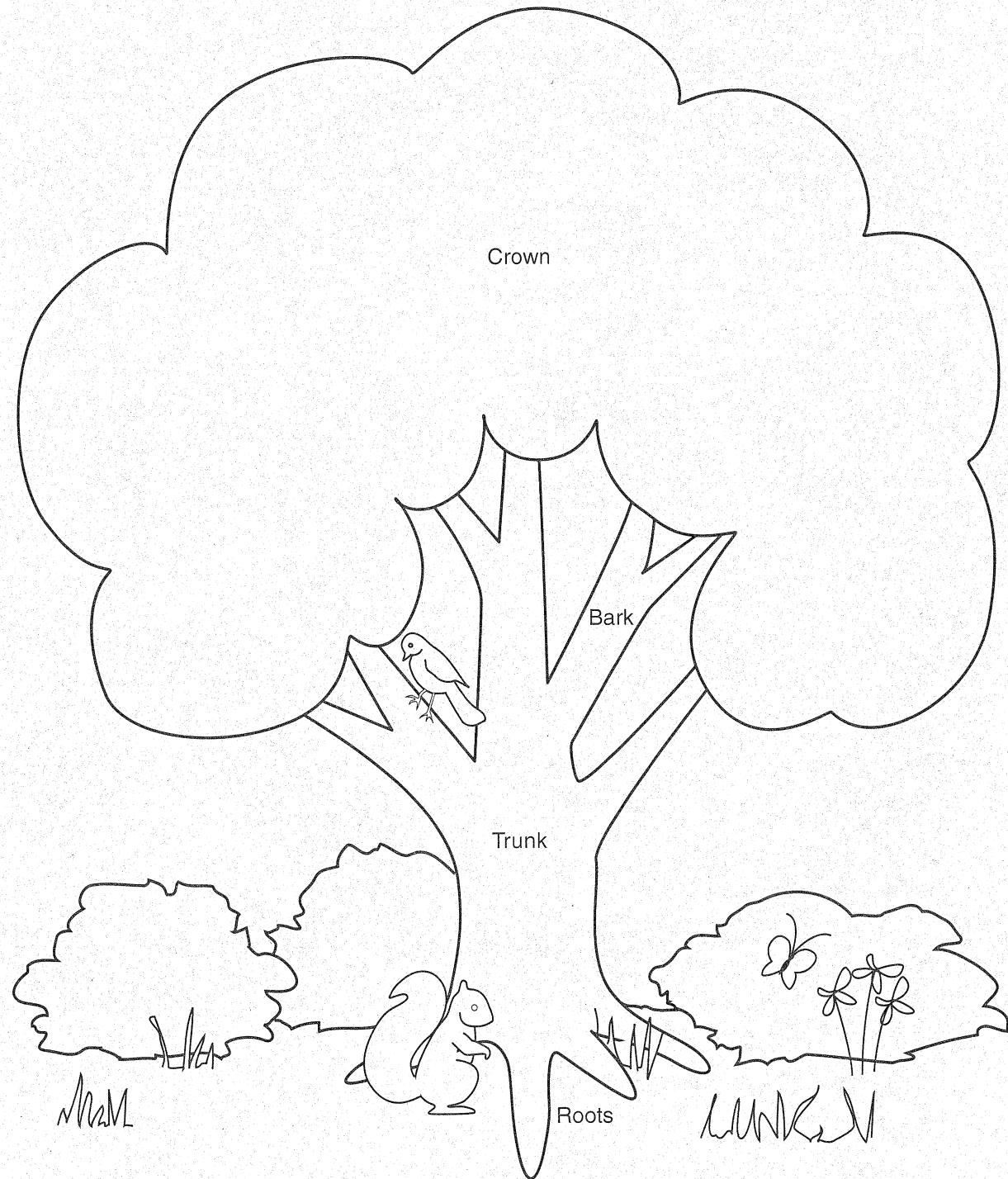


ACTIVITY SHEET 1B

WHAT IS A TREE?

Create a large construction paper tree on the bulletin board. Label the roots, trunk, crown, and bark.

Students participate by adding other things that share a tree's living space: grass, squirrels, birds, mice, woodpeckers, flowers, shrubs, bushes, etc.



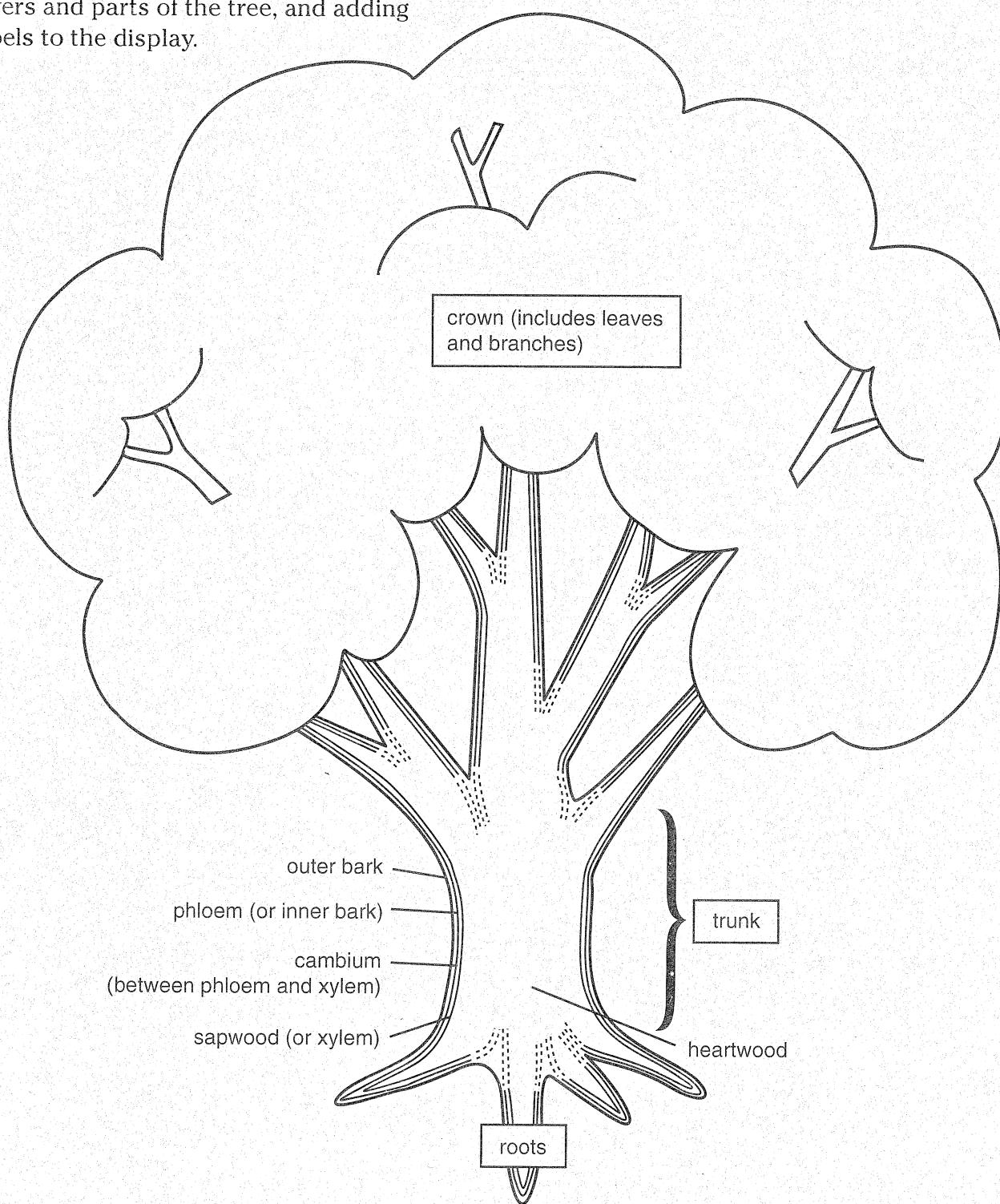
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ACTIVITY SHEET 1C

PARTS OF A TREE

Make a large tree cutout (3 1/2 to 4 feet tall). Post on a bulletin board or wall.

Students participate by painting or coloring the tree, drawing in the layers and parts of the tree, and adding labels to the display.



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