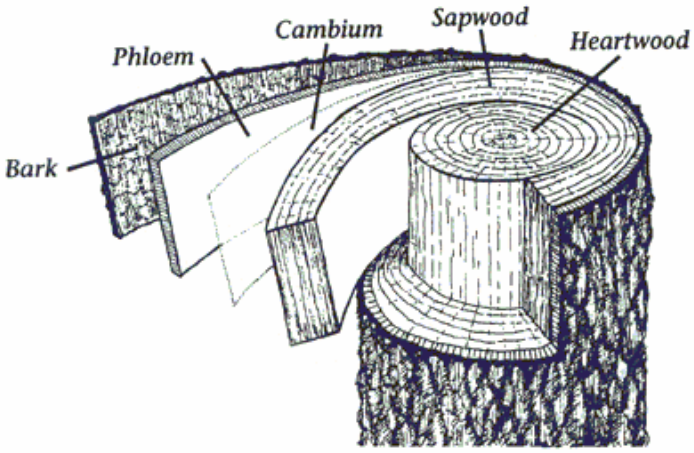
Grade: 4

Taking a Closer Look

Trees have common features that differ in structure and scale.

Teacher Background Reading

Tree species can be identified by looking at several different features: leaves, twigs, bark, flowers, fruit, and seeds. Once the features of a tree are observed, the tree can be identified by using a dichotomous key. The word “dichotomy” means to divide organisms into two groups by comparing their features, generally based on a characteristic present in one group and absent in the other. Identification keys ask a series of questions, and use the answers to narrow down the order, family, genus and species of an organism.



Leaves are the food factories of a tree, as they capture energy from the sun and convert it to sugars and other food molecules. The trunk and branches have the “pipes” inside trees, and the trunk provides support for the tree to grow tall and straight. The roots are the sponge that absorbs water for the tree, as they absorb water and nutrients from the soil.

Because of the structural strength of solid wood and wood fibers, we get many wood and paper products from trees. Most fruits and nuts are produced on trees. Trees also produce many chemicals that are refined into products that we use in our daily lives.

Trees help keep homes and cities cool, provide shade, remove carbon dioxide from the air and release oxygen, control erosion on hillsides, increase water held in soil after storms, supply composted soil through decomposition, and make the world a more beautiful place. ■

Vocabulary

Broad-leaf: a tree with wide leaves, generally deciduous

Cambium: a very thin layer of cells growing just inside the bark, making cells that become new phloem and xylem cells

Conifer: a tree that bears its seed in cones, with needle-shaped leaves that are evergreen

Deciduous: a plant that periodically loses all its leaves, before cold winter temperatures or in response to drought

Dichotomous key: uses comparisons to identify an object

Evergreen: a plant that keeps its leaves year-round

Heartwood: the older hard non-living wood that is produced from xylem cells, and provides strength for the tree to grow tall and straight

Phloem: connected cells inside the bark that transport sugars from the leaves to other parts of the plant

Xylem: connected cells that transport water and nutrients from the roots to above-ground parts of the plant (also called sapwood in trees)

Find a spot in nature you can use for the lessons - either in the schoolyard or in a park nearby with trees or bushes. Check for any hazards. Describe the boundaries of the outdoor area that you will be using for the lessons and explain acceptable and unacceptable behaviors outdoors. Much of the class discussion, etc. can also be done outside.

Note: Worksheets are available for all lessons, though please save paper when possible by having students use journals, notebooks or scratch paper.

Grade 4/Lesson 1:
Name That Tree

Students will learn how trees are identified and measured.

Learning Outcomes

Students will learn the key features used to identify trees and apply that information to identify local trees. Students will learn methods to measure trees and calculate their benefits to the community and from an environmental standpoint.

MATERIALS

- Paper for drawing or construction paper - 1 per group
- Pencils and colored pencils
- Copies of "MY SCHOOLYARD (OR PARK) TREE" - 2 pages or student science journals
- Copies of "Tree Identification Guide" - 1 per group
- Copies of "Tree Clues" Sheet - 1 per tree/group - made from students work in Lessons 1 and 2
- Clipboards or folders - 1 per group
- Copies of "Tools for Measuring Trees" worksheet - 2 per group
- Metric measuring tape, or 3-meter lengths of string and meter stick

Getting Ready

Copies of "Tree Identification Guide" (1 per group) and "Tools for Measuring Trees" (2 per group) worksheets - see student handouts. Identify trees in the schoolyard or nearby park with numbers or labels, so assign one tree to each group.

ENGAGE:

Briefly review the ways that students have learned to identify trees, noting these are patterns observed in nature.

Ways to identify trees:

1. Looking at the shape of the tree
2. Arrangement of leaves on branches
3. Color and shape of leaves
4. Where the tree grows

Review math skills for measuring trees. Use metric system for measurements. Determining the height of the tree:

Review the geometry of a right triangle, as that is the core principle in the tree height measurement. Draw two right triangles on the board. The pencil serves as the two identical sides of one triangle, first when held in front of the tree (with one end at the ground and the other end at the top of the tree), and then when held horizontally to and visually parallel to the ground (with one end at the base of the tree). We know that the length of the pencil is the same, whether it is held vertically or horizontally.

Another right triangle is formed by the height of the tree and the horizontal distance on the ground between the student and the base of the tree. Since the length of the two sides of the triangle are the same, the height of the tree and the horizontal distance on the ground are the same. When the length of the ground is measured (which is the distance between the other student and the base of the tree), we can assume that is the same distance as the height of the tree. (Actually, the length of the pencil is unimportant, it is just a way to visually mark the height of the tree and the equivalent distance on the ground.)

Determining the circumference of the tree:

Review the relationship between the diameter and the circumference of a circle.

Students will measure the circumference by putting a tape measure around the tree, or by placing a yarn around the tree and marking the distance with a marker then measuring it in the classroom. After determining the circumference, they can then calculate the diameter by dividing this distance by Pi.

EXPLORE:

Break students into groups of 4 or larger, depending on how many trees there are to choose from. Pass out the worksheet, “My Schoolyard (or Park) Tree and spread students out among trees. Groups select their tree and answer the questions in the handout or in their journals.

Pass out 4 index cards or pieces of scrap paper to each student. On each card or paper, students will write a clue to describe their tree. Each student will write four clues to describe their tree for a total of 16 cards per group. The clues might describe the tree's bark and the shape of the tree, for example, 'I have smooth white bark" or "I have leaves with teeth on the edges."

Each group will read the 16 clues to determine the 6 most descriptive clues. On a separate piece of paper, one group member will write these 6 clues.

Students will return to the trees, and use the "Tree Identification Guide," their clues, and their observations in "My Tree's Journal" to identify their tree. If the tree is not one of the ten trees listed in the "Tree Identification Guide," a twig and its leaves needs to be cut from the tree. Students can take a picture that they can use when they try to identify it online. If possible, the class can invite an urban forester, arborist, landscape architect or knowledgeable parent to help them identify or confirm the trees in their schoolyard.

Online resource for tree ID: www.urbantreekey.org.
(This is written for urban trees in California.)

NOTE: this is an exercise for categorizing trees and using a dichotomous key, rather than expecting to find the name for each tree. Students can be challenged to solve the mystery of the names of trees in the schoolyard.

EXPLAIN:

After students have identified the trees, regroup and discuss how students felt about using the student descriptions and drawings to identify the trees. What kind of information would make it easier to identify the tree?

Discuss if the "Tree Identification Guide" was easier to use and why. (Write down the tips the students come up with and transfer to the board when you go back inside.)

ELABORATE:

Next, students will get back into their tree groups to take measurements of their tree. Model these steps for the class, for one tree. Explain that urban foresters use the height and diameter of a tree to describe its size.

Pass out the "Tools for Measuring Trees" worksheet, pencils, yarn and the meter sticks.

Model how to complete each activity before releasing the students outside to take their measurements.

Students will use the "Tools for Measuring Trees" worksheet to make detailed measurements of their trees.

A designated group member will need to record the information for the rest of the group to add to their journal when they get back to the classroom. Have the students record the height, circumference and the diameter of their tree under question #1 of their tree prompts. Guide students through each step of the process and walk between groups to assist.

EVALUATE:

Ask students to think about how they benefit from the trees in their schoolyard and in general. Give each student a blank piece of paper; have each draw a small tree in the center. Have students draw eight lines radiating from their tree like the spokes of a wheel. On each line, have them write something the tree gives to them (beauty, shade, protection from wind, cleans the air, furniture, pencils, paper, apples, something to play on).

EXTENSION:

Invite an urban forester, arborist, or landscape architect to visit the classroom, to assist with tree identification and talk about their career. Students can also practice identifying the other trees. Start with the "tree clues" written by each group, and give each group the clues from another group. Have students locate the tree that they think the clues describe. One group member returns to the tree they described and checks whether other groups have found that tree from the clues.

RESOURCES

San Diego Tree Map Project:
http://sandiegotreemap.org/resources/

Common urban trees in California are included in the Urban Tree Key, at:
www.urbantreekey.org.

REFERENCES:

American Forest Foundation (2012). Name That Tree. In *Project learning tree: Pre K-8 environmental education activity guide* (6th ed., pp. 288-290). Washington, DC: Author.

Grade 4/Lesson 2:
Transportation Inside Trees

Water, nutrients, and food move up and down in trees.

Learning Outcomes

Students will understand that tree trunks have specialized cells that transport water, nutrients, and food and provide strength for the tree.

MATERIALS

- Celery stalks, one for each pair or small group of students, preferably with leaves at the top
- Sturdy beaker or glass jar (so celery stems don't tip it over)
- Red food coloring (and additional colors if you would like to extend this activity)
- Tap water
- Scissors or knives to cut celery
- Student journal to record data
- Tree "cookies" or horizontal cross sections of trees (about 1" thick), one per group of 3-4 students
- Copies of Student Reading, "Transportation Inside Trees"
- Student journals or plain paper, and colored pencils
- Optional-white carnations as an extension of the lesson

Getting Ready

Review the Teacher Background Reading.

Have pencils and journals (or plain paper and clipboards) ready for students to take outside to draw their trees.

Gather materials for the experiment and have materials divided for groups of 2-4 students.

Have your copy of the Student Reading available to use on the document camera or have copies available for each student or to read in pairs.

ENGAGE:

Review vocabulary with the class.

This activity can be done outdoors. Ask students to tell about where the water pipes go in their house, apartment, or school buildings. (Under and through the house to the bathrooms, kitchen, garden, washing machine and then to the street and sewer pipes.) How does this work in our bodies with our blood? Engage students in a discussion about how blood circulates water, food, and many other materials in the body through arteries and veins. Compare these to the tree "pipes" that are specialized cells that carry water, nutrients and food to different parts of the tree. Use a tree on the schoolyard and have students point to plant parts and use vocabulary to explain the trees ability to get food and water to its parts.

EXPLORE:

Go to their tree in the schoolyard. Draw an outline drawing of the tree, with branches, stem and roots. Make sure it shows the difference in scale, how big the trunk is and how small the branches are. Then draw arrows showing the direction that water and nutrients move from the roots to the leaves. Draw arrows for where food moves from the leaves to the trunk and roots, and from one part of the tree to another. Look carefully at the bark.

All flowering plants have xylem and phloem, just as trees do. The movement of water through the stem can be easily observed in celery. In the classroom, set up the materials for students to do experiments with the dye, water and celery.

Start by asking students what they think will happen if the celery is placed in the colored water. Have the students record what they think will happen to the celery. Put a few drops of red food coloring in a sturdy beaker or glass jar. Start with a stalk of celery for each pair of students. Use a knife to cut about 1/4 inch off the bottom of the celery stalk. Put the cut end of the celery into the cup of food coloring. The colored water will travel up the celery stalk in the xylem (water tubes) and the leaves will slowly change color.

Start with 3-4 small pieces of celery for each group of students. After 30 minutes, remove the celery from the cup. Use a knife to cut the celery in half, for a cross section. Ask students to figure out how to observe the dye and measure how far the colored water travels in the stalk. Let students try different methods.

Invite students to ask questions about what would happen if conditions of the plant (size of stalk) or environment (temperature?) were changed. Then write a scientific (testable) question and predict reasonable outcome based on a cause and effect relationship. (For example, water will move faster in the celery if it is kept at room temperature, compared with keeping celery in refrigerator. Or making diagonal cuts in the celery disrupts water movement.) Students can design a simple experiment to test these questions, using multiple stalks of celery. Provide more stalks of celery for each group. They can record data in their science journals.

EXPLAIN:

With a partner or in your small group, discuss the scientific question and the information gathered to test the question. Share with the entire class. Ask students what the results tell them about water moving in a tree. What happens if the celery or the tree is cut across the xylem?

The celery experiment shows and tracks capillary action in a plant using a celery stalk, by the movement of colored water. The xylem or tubes that transport water can easily be seen by looking for the colored circles on the bottom of the stalk. The rate of capillary action (or water movement) can be measured by monitoring the appearance of colored circles up the length of the stalk.

Students read the “Transportation inside Trees” student reading.

ELABORATE:

Look at the tree cookies, one per group. Identify the structural elements (bark, xylem or sapwood, heartwood). Cambial layer and phloem are too narrow to see in most trees. Trees produce new wood every spring and summer, and this annual growth can be seen in the tree rings. Each ring represents a year of growth, so count the age of the tree from the rings.

Ask students to remind you what things a tree needs in order to grow (water, sunshine, soil/nutrients, and space to grow). Ask students why one ring might be thicker than another (more nutrients, water, or sunshine one year). Ask why a ring might be thinner one year (drought, poor conditions for growing).

EVALUATE:

Draw a picture in which the xylem and phloem could be destroyed. (Fire, insects, drought, a tree limb breaking off) Share pictures and explain how this could effect your tree.

What would happen if the xylem and phloem cells were destroyed? How would the water get from the roots to other parts of trees? How would the food get from the leaves to other parts of trees?

What could happen to the tree? Discuss.

REFERENCES:

American Forest Foundation (2012). Tree Factory. *In Project learning tree: Pre K-8 environmental education activity guide (6th ed., pp. 269-272).* Washington, DC:

American Forest Foundation (2012). Tree Cookies. *In Project learning tree: Pre K-8 environmental education activity guide (6th ed., pp. 327-331).* Washington, DC:

Grade 4/Lesson 3:
From a Tree to Me

Describe how humans, like all other organisms, obtain living and nonliving resources from their environment.

Learning Outcomes

Students will understand that people get many products from trees and will be able to identify some of those products.

MATERIALS

- Collect a variety of products (or photos of products) that come from trees
- Include solid wood products such as wooden toy, broom handle, wooden spoon, pencil, toothpicks, and chopsticks.
- Include paper products such as a book, cardboard box, magazine, egg carton
- Include food products such as apple or orange, chocolate, nuts, maple syrup, vanilla extract, and cinnamon
- Include cleaning products such as nail polish, Pinesol or other pine cleaner
- Include "surprise" products such as chewing gum, cork, cellophane, varnish or paint, cosmetics, nail polish, and latex gloves
- Collect some objects that are not made from trees, such as metal utensils, foil, cotton cloth, a dollar bill, and plastic items
- Copies of "From a Tree to Me" worksheets - 1 per student

Getting Ready

Review the Teacher and Student Background readings.

Have materials ready to make collages and ornaments.

Have objects scattered around the classroom for examination and sorting.

ENGAGE:

Hold up a branch, a chocolate bar, and a magazine. Ask students what these three things have in common (all three come from trees). Explain that trees are made of a fiber called cellulose, and most of the fibers are in the trunk of the tree. Cellulose is the main ingredient in many products, such as paper. Eucalyptus trees are used to make medicine. Oaks have acorns that native Americans used for food. Cinnamon comes from the inner bark of a tree, and is used as a spice. Cacao trees produce beans used for chocolate, and coffee trees produce beans that are roasted for coffee.

EXPLORE:

Create a chart on the board with two columns - From Trees and Not from Trees.

Divide students into groups of two. Each pair writes these two headings on a piece of paper or their science journal.

Have students move around the classroom examining objects and deciding whether they come from trees or not. Students write the name of the object under the appropriate columns in the student worksheet, “From a Tree to Me.”

Then have students move around the schoolyard repeating the activity.

EXPLAIN:

Back in the classroom, have each group tell you one item from their list and which column they wrote it in. Go around the classroom until you have everything the students listed on the board. Discuss each item and how it relates or does not relate to trees.

Ask students how they think these products are harvested. Do the trees need to be cut down? If so, what effects does using trees have on the environment? (Trees are cut down to make the products we need. Forest lands are replanted or reseeded, and trees grow large enough to be harvested in 40 to 80 years.)

ELABORATE:

What are ways that we can reuse products from trees? Still working in pairs, have students pick an item from their chart that came from trees and come up with a plan on how they could reuse that item to do something else. Let them walk around the room and choose an item to repurpose. Each group should pick one item. If there aren’t enough items, you can have some groups double up.

EVALUATE:

Write an opinion piece on why more trees should be planted in schoolyards. Think of shade, beauty, protection from the wind, and other benefits that students would get. Or write an opinion piece about how important trees are to us and why products made from trees should be reduced, reused, or recyled.

REFERENCES:

American Forest Foundation (2012). We All Need Trees. In *Project learning tree: Pre K-8 environmental education activity guide* (6th ed., pp. 65-68). Washington, DC: Author.

Standards Grade 4:

Next Generation Science Standards

Lesson 1: Name That Tree

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

All Lessons: California Science Standards

Life Sciences

2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:

a. Students know plants are the primary source of matter and energy entering most food chains.

3. Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept:

a. Students know ecosystems can be characterized by their living and non-living components

Investigation and Experimentation

6b. Measure and estimate the weight, length, or volume of objects.

All lessons: Common Core Standards

Literacy – Reading

RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Literacy – Writing

W.4.2d Use precise language and domain-specific vocabulary to inform about or explain the topic.

Literacy –Speaking and Listening

SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

SL.4.3 Identify the reasons and evidence a speaker provides to support particular points.

Literacy – Language

L.4.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.

Grades 3 & 4/Lesson 1: Student Reading

Telling Trees Apart

In the simplest sense, there are two kinds of trees in the world: conifers, or coniferous trees, and broad-leaf or deciduous trees.

Needles or Broad Leaves

Conifers have seeds that develop inside the cone. Pines, junipers, cedars, and cypress are all examples of conifers in our region. For the most part, conifers also have needle-shaped scaly leaves and they're evergreen. That means they don't lose all their leaves each year but instead stay green year-round.

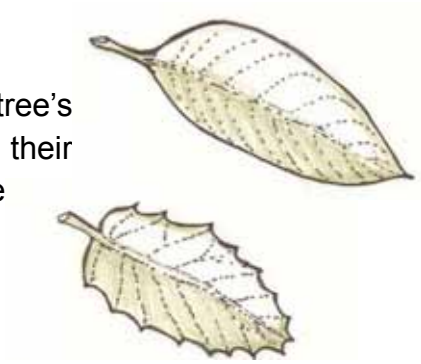
Deciduous trees such as the California Sycamore, Crape Myrtle, Cottonwood, and Liquid Amber have broad, flat leaves. They lose all of their leaves each year, usually in the fall.

Some trees, however, aren't typical conifers or deciduous trees. For example, Dawn Redwoods have cones and needles, but lose their leaves every year and therefore are deciduous. Fern Pine trees have needle-shaped leaves and are evergreen but have berries and not cones, and a Coast Live Oak is a broad-leaf tree that's evergreen.

The Shape of Leaves

The overall shape of a leaf gives clues to the tree's identity. For example, Eucalyptus have long, slender leaves; Coast Live Oaks have oval-shaped leaves; Cottonwoods have triangular-shaped leaves. The shape of the leaves differ in many ways. For example, the tips of the leaves may be notched, pointed, rounded or tapered. And the bases of the leaves may be squared, rounded or heart-shaped.

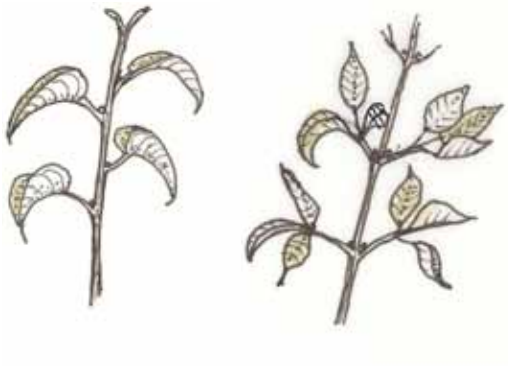
Margins



The edges or margins of leaves can also provide clues to the tree's identity. For example, some leaves have teeth (serrated) along their margins and some leaf margins are smooth. Some leaves are lobed, with several points.

Textures

Some leaves are completely hairy, others have hair on only one side, and others are completely smooth. Leaves may also be thick or thin, rough or waxy.

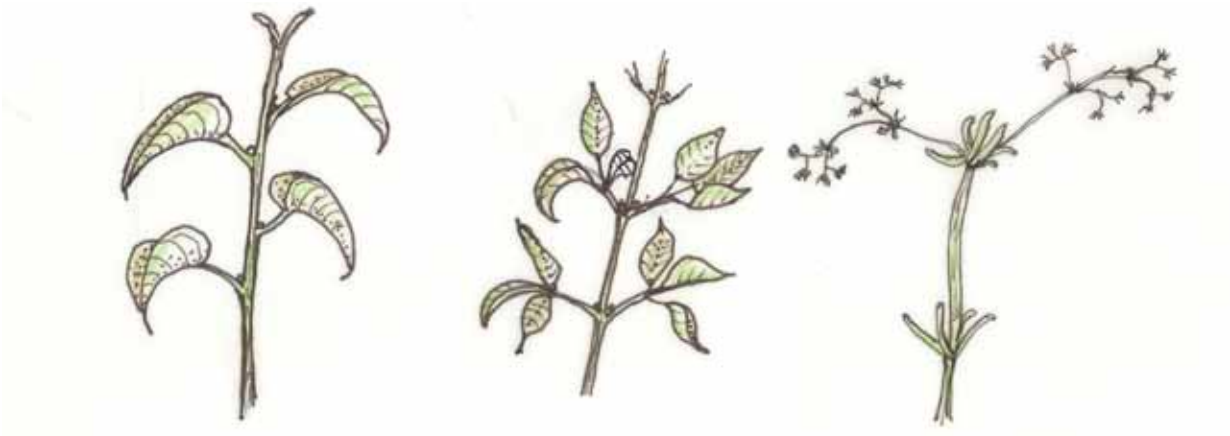


Simple and Compound

When most people think of leaves, they think of simple leaves. Simple leaves connect directly to the branch. Oak, Sycamore, Cottonwood and many other trees have simple leaves. Compound leaves, on the other hand, are made up of several leaflets. Jacaranda, California Pepper, and Chinese Flame trees all have compound leaves.

Leaf Arrangements

Another characteristic to identify a tree is the way its leaves are arranged on the twigs. Many trees have alternate leaves that are staggered along the twig. Other trees have opposite leaves that grow in pairs along the twig. Some leaves grow in whorls, or are whorled. The leaves on pines, and other needle-leaved trees also grow in patterns. For example, leaves on pines may grow in clusters of two, three, or more.

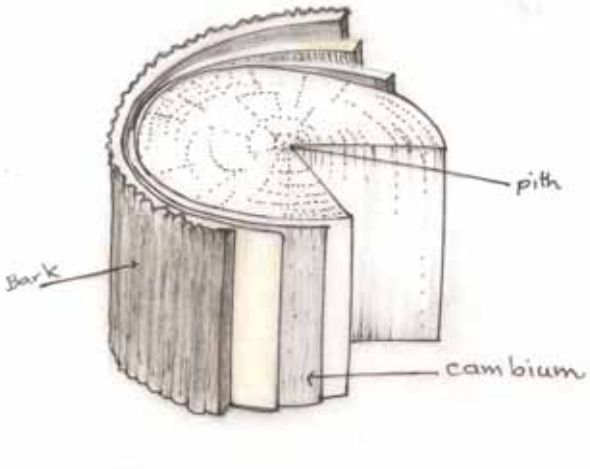


Twiggy Clues

If you know what to look for, even leafless twigs on a tree can tell you the tree's identity. This is especially helpful when identifying deciduous trees in the winter. The locations of the leaf scars or buds are on the twig, indicate whether the leaves grow in an alternate, opposite, or whorled pattern. (Leaf scars are the places on the twigs where leaves used to be attached.) The size, color, and shape of buds can be used to identify trees. Spines and thorns on twigs can also help identify a tree.

Flowers and Fruit

Trees produce flowers that have distinctive shapes and colors. Many trees have only female or male flowers. Different trees produce different kinds of fruit, such as berries, winged seeds, nuts, or pods. Different conifers produce different kinds of cones. The shape, color, texture, size, and other characteristics of the flowers, fruit, and cones can be used to identify trees.



Bark Basics

Many people can identify trees just by looking at the color and texture of tree bark. For instance, bark may be shaggy, smooth, or rough. Bark may have deep furrows or markings. Sycamore is an example of a tree easily identified by its smooth peeling bark that has a "camouflage" pattern. However, when using bark to identify a tree, it's best to look at bark growing on the trunk rather than on branches and twigs (because the bark on branches is thinner and newer, it may look quite different from the trunk). Bark also looks different as a tree gets older.

Shaping Up

Many trees have characteristic shapes that can be used to identify them. In fact, just by glancing at the shape of a distant tree and the color of its leaves, some people can tell what kind of tree it is. ■

Grade 4/Lesson 1

My Schoolyard (or Park) Tree

Scientist's Name_____Date_____

1. Make a sketch of your tree. Draw the shape of its trunk, branches, and canopy (tree top).

2. When you've learned how to measure trees, write your tree's measurements here:

HEIGHT	CIRCUMFERENCE	DIAMETER

Grade 4/Lesson 1

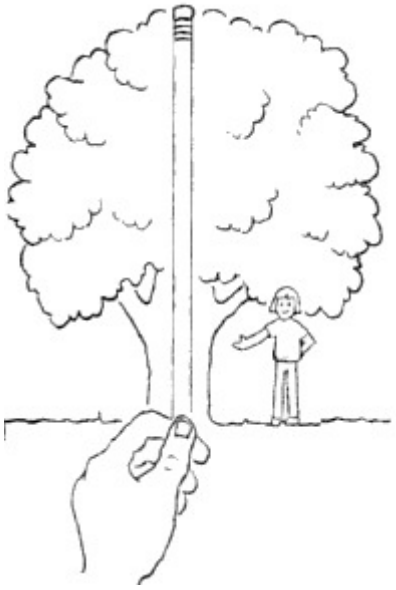
My Schoolyard (or Park) Tree

1. Trunk shape	2. Bark: color, texture, pattern
3. Branches: thickness, shape	4. Sketch attachment of leaves to branch
5. Leaf: shape, color, location of attachment	6. Draw or attach a leaf
7. List and sketch any seeds, fruit, flowers or cones	8. Describe any evidence of animals

Grade 4/Lesson 1

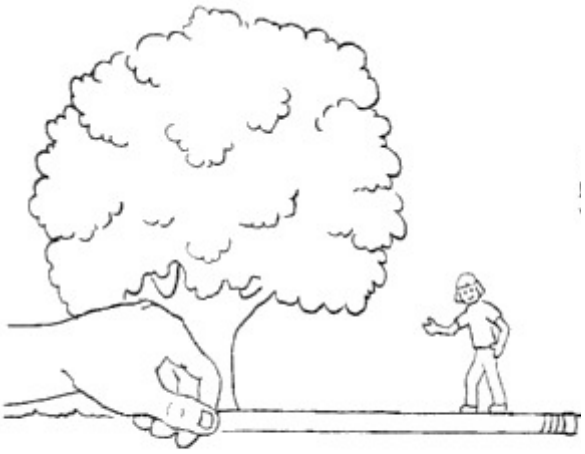
Tools for Measuring Trees

Measuring Tree Height



Here is a simple way to measure the approximate height of a tree. You will need an unsharpened pencil, a tape measure and a partner.

1. Starting at the base of the tree, step backward until you are further away from the tree than the tree's base is from its top.
2. Ask your partner to stand next to the tree's base.
3. Hold a pencil straight up by its point. Close one eye and hold the pencil so it lines up with the tree.
4. Move yourself forward and backward until the pencil looks as tall as the tree. Without moving your arm, turn the pencil sideways (keeping your thumb lined up with the tree trunk) so it looks as if it is lying on the ground (see the illustration).



5. Ask your partner to walk away from the tree in the direction of the pencil. To you, it will seem as if your partner is walking along the pencil. Tell your partner to stop when it looks like he or she is lined up with the end of the pencil.
6. Measure the distance between your partner and the tree's base. This will be the approximate height of the tree.

Measuring Tree Circumference and Diameter

Diameter = Circumference / π

To find the circumference of a tree, stand on the uphill side of the tree's trunk and measure from the base up to 1.4 meters (4.5) feet. Then, using the tape measure (or a piece of string) circle the trunk at that height and note the measurement. This is the circumference. You can calculate the diameter of the tree by dividing the circumference by pi (3.14).

Grade 4/Lesson 1

Tree Identification Guide

Identification Key for Common Urban Trees in Southern California

(Common name, followed by genus and species in Latin)

1. Needles, in bunches ……..... Pine trees, *Pinus spp.*
   Leaves, go to 2

2. Leaves simple, go to 3
   Leaves compound (divided into leaflets), go to 9

3. Leaves simple and alternate, go to 4
   Leaves simple and opposite, go to 7

4. Leaves simple and alternate:
   Leaves lobed (with indentations)... California sycamore, *Platanus racemosa*
   Leaves not lobed, go to 5

5. Leaves not lobed, edges rough..... Coast live oak, *Quercus agrifolia*
   Leaves not lobed, edges smooth, go to 6

6. Leaves not lobed, edges smooth:
   Leaves wide and about 1” long ….. Fig trees, *Ficus spp.*
   Leaves wide and about 3” long ….. Magnolia, *Magnolia grandiflora*
   Leaves narrow and bark peeling.... Blue gum, *Eucalyptus globulus*

7. Leaves simple and opposite:
   Leaves lobed (with indentations)... Maples, *Acer spp.*
   Leaves not lobed, go to 8

8. Leaves simple, opposite and not lobed:
   Leaves wide ……..... Crape myrtle, *Lagerstroemia indica*
   Leaves narrow ……..... Olive tree, *Olea spp.*

9. Leaves compound and alternate.... Pepper tree, *Schinus spp.*
   Leaves compound and opposite.... Jacaranda, *Jacaranda mimosifolia*

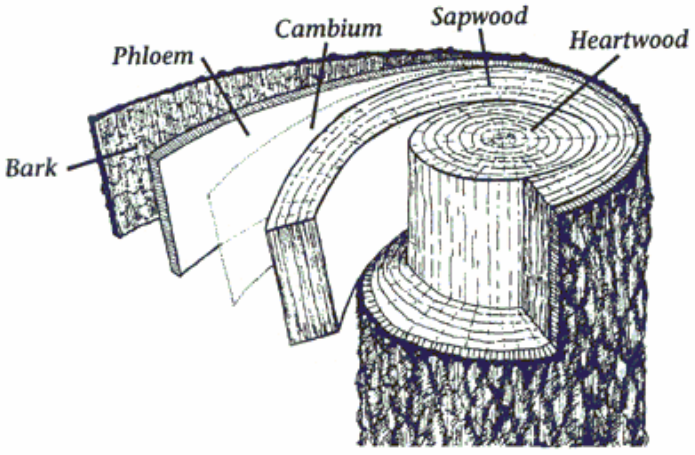
Grade 4/Lesson 2: Student Reading

Transportation Inside Trees

The trunk and branches are the “pipes” inside trees. They contain the xylem cells that transport water and nutrients to the leaves. These cells are called sapwood. The stem and branches also have the system of phloem cells, also called inner bark, that transport the sugars from the leaves to the rest of the tree. Xylem and phloem are made from a thin layer of cells inside the bark, called the cambium.

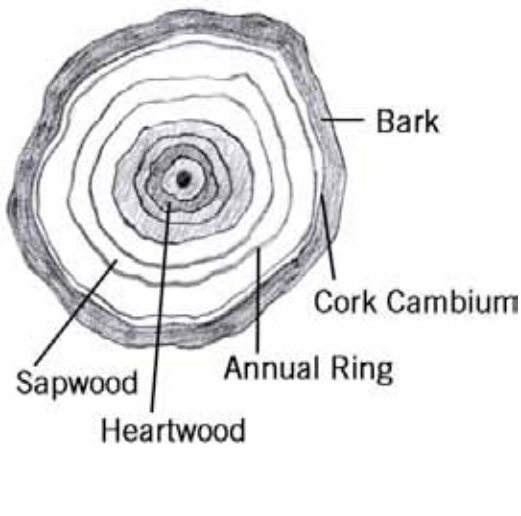
The trunk provides support for the branches, which in turn support the tree’s leaves. The strength of the trunk comes from wood produced by the xylem each year. Older xylem becomes part of the heartwood, which is the center of the tree. It is the wood used to make lumber and furniture. Wood has thick cell walls that are mostly cellulose, which is made into paper and many other products.

Here’s a look at a tree trunk from the inside to the outside (see diagram)



The wood produced each year can be seen in annual rings in the cross-section of a tree. Every growing season, a tree adds a new layer of wood to the trunk and branches. The wide light-colored “early wood” is produced when the tree is growing rapidly in the spring. The narrow dark “late wood” is produced in the drier summer and fall. Trees produce wide tree rings when there is abundant rainfall. In a drought year they produce narrow tree rings. Therefore, tree rings provide historical evidence for climate conditions.

Bark protects the tree from injury caused by insects and other animals, by other plants, by disease, and fire. Bark characteristics vary from species to species. It may be thin, thick, spongy, rough, smooth, or covered with spines.



A cross-section of the tree shows annual rings, produced by xylem cells each year.

Roots are the sponges that absorb water and nutrients for the tree, from the soil. The tree's roots also help anchor the tree in the ground. 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 covered by very fine root hairs that absorb the water from the soil. ■

Grade 4/Lesson 3: Student Worksheet

From A Tree to Me

Sort the objects around the room into categories to show whether they come from trees, and if so, how they are made. Write the names of the objects below.

WOOD	FOOD
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5._____	5._____
PAPER	**NOT FROM TREES**
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5._____	5._____

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