Plant Anatomy:

Plant Families
How big is that tree?

To measure the size of the CROWN, place a marker such as a stone or hold a stick under the edge of the widest part of the tree branches. The crown is all the branches of the tree. These two boys carefully chose to be opposite one another and placed a stick under the end of the longest branch above them. Someone will come along and measure the distance between the two sticks. This will tell them the width of the crown of this tree.

To find the CIRCUMFERENCE, measure four and a half feet from the ground, and using the measuring tape, wrap it around the trunk and find out how big around the tree is.

It would be difficult to measure the height of most trees. A good way to ESTIMATE the height is to hold a yardstick in your hand and put your arm out straight. Walk away from the tree until it seems that the tree and the stick are the same heights. Have someone use a tape measure and measure how far it is from the tree trunk to a spot on the ground just under the stick you are holding. This is an estimate of the tree’s height!
We have learned that there are many differences in plants! Let’s review:

Some plants reproduce by flowers and some by seed-bearing cones.
Some plants keep their leaves and some drop them every year.
Some plants start with one leaf and others start with two.
Some plants have broad leaves and some have needles.

Soon we will examine how some plants dieback and disappear in the winter, while others stay woody.

There is a lot to learn about plants! If you find they are interesting, you can learn about them all through your life. For now, the most important thing for you to remember is plants are an ESSENTIAL part of the earth’s ecology.

Plants make their own food by photosynthesis. We’ve seen an example of a plant cell and a drawing of what a plant leaf would look like under a microscope. Plants have the UNIQUE ability to make their own food because of what is in those cells. Chloroplasts in plant cells help the plant take sun energy, water and nutrients to make their own food energy.

Leaves are the main place where photosynthesis occurs. Plants take in water and air through their roots. But leaves also take in air (carbon dioxide gas) and water through tiny openings. They also release water through a process called EVAPO-TRANSPIRATION. And, as a part of photosynthesis they release oxygen. Leaves may seem tough, but they can be damaged when the environment is extreme.

Trees that have needles for leaves generally don’t lose them in the fall. Those needles are created to work in the environment. They can thrive where other plants could not survive. We call them conifers or evergreens, don’t we?

Trees that lose their leaves (deciduous) do so because it helps the tree survive the winters. Because of evapo-transpiration, it is better for some trees to get rid of their leaves before the winter. A chemical in the tree moves to the stem of the leaf and forms a wall between the branch and the leaf. The leaf drops off and the tree puts its stored energy into making stronger roots instead of the work of growing new leaves and flowers like it does in the spring and summer.
Flowering or not flowering? One way scientists organize plants is to separate them into two groups called ANGIOSPERMS and GYMNOSPERMS. Those are difficult names that describe whether plants have flowers as part of their life cycle or not.

ANGIOSPERM plants make flowers as part of their life cycle. Most of the plants you can think of are angiosperms.

GYMNOSPERM plants do not create flowers to reproduce but produce seed-bearing cones. You have probably seen pine cones. Those cones are part of the plant’s life cycle!

Plants of all sizes belong in these two categories. For the most part, when we talk about trees, we call them BROADLEAF or CONIFER. Broadleaf trees generally have flowers. Conifers are cone-bearing plants and are often called EVERGREENS.

You may not be able to remember the names of these two plant families, but now you know that some plants:
1. make flowers for their life cycles and usually drop their leaves
2. others make cones instead of flowers and usually do not drop their leaves (needles).

Flower producing plants can be further sorted by the way they create their first tiny leaf when they are baby seedlings.

Flower producing plants start out life as a small seedling with either one or two leaves. These very first leaves are called COTYLEDON. (Take that word apart and pronounce it ‘cot-e-lee-don’).

In our language, the word part (or prefix) ‘mono’ means one. The word part bi- or di- means two.

--A MONOCOT is a flowering plant with one first leaf.
--A DICOT is a flowering plant with two first leaves.

This may not seem important to you but it is to the plant. Monocots and dicots grow up to be very different types of plants!
monocots

one new shoot and leaf

flower parts in multiples of threes

leaf veins parallel

vascular bundles scattered

dicots

two new shoots and leaves

flower parts in multiples of four or five

leaf veins in a net pattern

vascular bundles in a ring

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Is it a tree? a shrub? or just a plant?

We generally call something a tree if it has one main stem or TRUNK. It isn't really a matter of size, although trees are usually taller than shrubs. **A SHRUB is another woody plant, like a tree, but it usually has more than one stem or trunk.**

Some plants stay around in the winter and there is nothing to see but their bare branches. Some plants seem to disappear and there is little left of them other than a bit of dying leaves on the ground.

This is one more important difference in some plants!
Plants can be WOODY or HERBACEOUS

**HERBACEOUS** is the fancy word for plants that don’t have tough, woody stems. Many flowers are herbaceous. This does not mean they are dead when you can’t see them, it means the stems will come back from the CROWN the next spring if they are PERENNIAL in your area. PERENNIAL plants, as you know, come back in the spring after they die back in the fall.

**ANNUALS** are plants that won’t come back in the spring, because they can’t survive the weather in your area or they have a short life span.

What about grass?
Grasses are a whole plant family themselves. There are grasses grown for grain, because we eat their seeds, and grasses that are grown to be our lawn.

Lawn grasses are called TURF. Grass is a monocot because it has one stem and no branches. Turfgrass has seeds, even though we don’t usually notice them. When turf is cut, the leaf blade is cut and re-grows. In a cold winter, grass stops growing and becomes DORMANT.
Is a mushroom a plant?

A long time ago, scientists thought that mushrooms were plants. Because mushrooms grow in the woods and other dark, damp places it seems like they are plants, doesn't it?

All organisms are categorized by the kingdom they are in. There is a plant kingdom, an animal kingdom, and a kingdom that contains plant-like organisms such as fungi, algae, molds, and sea kelp.

This unusual kingdom is called PROTISTA.

One big reason that mushroom and the other organisms in the protista kingdom are not plants is because they can't do that one important thing that only plants can do for themselves. Do you remember?

Mushrooms do not have chloroplasts in their cells, so they can't do photosynthesis and therefore can't be plants. Were you able to figure that out?

Fungi are used as foods and medicines. Yeast is a fungi. It is used to make bread rise. Some mushrooms are good to eat and some are not. In fact, some are poisonous! If you ever get a chance to go into the woods in the springtime, you will see many types of fungi on the ground and near trees.

The mushrooms that are in the grocery store are safe to eat and are grown to be a food. Never eat mushrooms that you find somewhere else.

In the same fungi group, there are some we don't like! Some can grow on plants and make them unhealthy. Some grow in our basements and can make us sick. Fungal diseases are one of the major pests of the plants we eat and admire.
1. Plant leaves can be very different but they all use these two things to do photosynthesis;
   a. sun energy and carbon dioxide
   b. water and oxygen
   c. cold weather and carbon dioxide

2. All plants have woody stems. True or False? ____________________

3. All plants start with two leaves. True or False? ____________________

4. Grass is not really a plant. True or False? ____________________

5. What is one interesting thing you learned about plant anatomy?
   ___________________________________________________________
   ___________________________________________________________
Vocabulary

anatomy - the science that deals with the structure of an animal or plant or one of its parts

angiosperm - the scientific name for plants that produce flowers as part of their life cycle

annual - plants that survive one growing season in a particular area

broadleaf - the term for plants that have broad leaves rather than needles

cambium- a layer of cells under bark and phloem; new cells are formed along this layer which cause the plant to grow larger each year

carbon dioxide - a gas in our atmosphere that plants use to make their own food energy; animals exhale carbon dioxide into the air

chloroplasts - an important part of plant cells that enables plants to create food energy for themselves in the process of photosynthesis

circumference - the measurement of something all the way around it

conifer - a term for plants that produce narrow needle-like leaves rather than broad leaves

consumers - animals or people that acquire (eat, buy, take) products created by others

cotyledon - the first and very important leaf or leaves of flowering plants

crown - a tree crown is all the branches and leaves of the tree; a plant crown is the base of the plant at ground level, above the roots and the source of new leaf growth

deciduous - the term for woody plants that drop their leaves before winter
dicot - the term for a flowering plant which produces two leaves on its shoot and will develop branches and leaves when mature

dormant - for plants, this means active growth stops due to a change in season

essential - something that is very important and needed

estimate - a good guess or calculation of something based on the information you can gather about it

evapo-transpiration - the way that plants release water back into the soil through their leaves; it is a form of evaporation when water changes into a vapor

evergreen - the general term used for plants that don't lose their leaves; most are conifers, but not all

gymnosperm - the scientific name of plants that don't produce flowers but create seed-bearing cones instead

herbaceous - plants that do not produce a woody covering to their stems and generally die back in the winter

monocot - plants that send up one shoot and one new leaf only, and will mature to have only one stem

needles - the name for the narrow 'needle-like' leaves of conifers

oxygen - the gas found in our atmosphere that animals must inhale to nourish their cells and stay alive; plants release oxygen

perennial - plants that complete a life cycle in one season and resume growth again for more than one year

phloem - phloem is the part of plants that transports food energy from leaves down to the roots.
photosynthesis - the way plants create their own food energy

protista - the scientific kingdom that includes fungi, molds, algae and other organisms

shrub - similar to a tree but usually has more than one woody stem

stem - the stalk or trunk of a plant; there can be one or many stems on a plant

trait - a quality of or a feature of something that stays constant

trunk - the woody stem of some plants, especially shrubs and trees

turf - grass that is grown and maintained to be a lawn or outdoor use area

unique - one of a kind; not like others

vary - to show variety or differences

vascular bundles - plant tissue that acts as waterways to move food energy, nutrients and water throughout the plant

veins - tube-like structures which allow water and sugars to travel through plants or in the case of animals, blood to the heart

woody - a plant that has bark over its stem rather than soft green tissue

xylem - xylem is the part of a plant that transports water and nutrients up to leaves
Pg 1 Here is an outdoor activity that can be done with most any shrub or tree. These techniques give estimates on size. To show how people do things differently and how estimates therefore vary, split your class into at least three groups and compare results back in the classroom. Ask your students whether they think all the numbers will be the same, and why or why not? Ask them if they should use the average of these figures to be more accurate, or do they feel their group’s results are most likely correct. Before any measurements are taken, you might want students to guess the results.

Needed for Tree Measuring Activity:

- at least two plant stakes or markers,
- a measuring tape and a yardstick.

Pg 2 This page reinforces three ways that plants can be organized by their differences, and adds one more. In general terms, plants can be deciduous, or evergreen. Most evergreens have needles but not all. There are very few hard and fast rules in plant science, just as in many other sciences. The focus of this page is that some plants lose their leaves in the fall and some don’t. The reason for this is generally based on the plant’s needs. Both broad leaves and needle leaves “do” photosynthesis, they are essential to a particular plant. However, leaves also use up energy, and release water. At times, leaves can be a detriment to hang on to for some plants. Plants with needles have evolved to make the best of both worlds - collect sun energy and protect water loss.

Pg 3 This page introduces two more ways that plants are divided into groups. Rather than focus on the scientific terms, have students discuss flowering and non-flowering plants. Have they ever noticed how many plants have some sort of flower on them? What time of the year (not always spring). Have they ever seen flowers on a pine tree? Remind students that a pine tree is not the name for all trees with needles, but only for one group of conifers.
Of all the plants producing flowers, they also can be divided into two groups called monocots and dicots. Plants that begin life with one leaf only will grow into plants that are very different than plants that produce two first leaves. Corn, grasses and palm trees are monocots. Very few will ever have branches. An interesting monocot subject is the palm tree.

Pg 4 One way to tell the difference between monocots and dicots is to examine their leaves. The leaf of a dicot will have veins in a webbed - pattern. Veins in a monocot leaf run parallel, and are often called blades. Remember, both monocots and dicots can have flowers (they are two types of angiosperms "flowering plants") but their stems are very different inside.
Are students aware of what a shrub or a tree is? Have they considered how some plants stay green in the winter, or look like dead branches, or just disappear? The exposure to plants will vary among students based on the experiences they have in and around their neighborhoods. One way to discuss this subject is to have a variety of photos or books, or catalogs showing plants in a yard or garden or field. By looking at the plants, can students tell if it is spring, summer or fall? What do many plants look like in the winter?

Plants change with the seasons; woody or herbaceous, deciduous or evergreen, perennial or annual. Choose one or two plants and discuss what will happen during various times of the year.

Mushrooms are not plants, they are fungi. All fungi have to get their food energy from other sources, such as decomposing plants and other materials. There are many types of fungi; they all have a complex life cycle. Reinforce to students that many types of mushrooms can be found outdoors but only certain kinds are edible. To be safe, they should only eat those found for sale at the market.

Fungus - single, Fungi - plural

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