HOW A TREE GROWS
Crown, Trunk, and Roots

All trees grow in basically the same way, whether they are seedlings or older trees! Trees grow in three different ways...

1. The tree's crown gets taller.
2. The tree's trunk gets wider around.
3. The tree's roots get deeper and farther into the soil.

So, how does the crown get taller?

HOW A TREE GROWS
Crown

The crown of a tree is made up of the branches and twigs at the top of a tree.
Growth occurs at the tips of all the twigs and branches on a tree.

The new growth is added at the very tips. In this way, the crown of trees gets taller!

It's very important that a tree gets taller as it grows. This is because the tree needs more and more sunlight for **photosynthesis**. If the tree didn't get taller, other trees would shade it.

Below are photographs of two twigs. You can click on the twigs to see the full-sized image. Can you see the new growth on these twigs?

How does the tree trunk get wider?

**HOW A TREE GROWS**

**Trunk**

The trunk of a tree is the part that's above ground before the branches start.

Underneath the **bark**, there is a thin layer of cells called the **cambium** (pronounced "cam-bee-um").

The cambium cells divide and make **new wood** on the inside and new **inner bark** on the outside. In this way, a tree gets bigger around as it grows!

A tree needs to get wider around as it grows. As a tree gets bigger, it needs more and more support to keep it from falling. The large tree trunk is what keeps the tree from falling!
Below is a photograph of a tree trunk unwrapped. You can click on the picture to see the full-sized image. Can you identify the inner bark, the cambium, and the wood?

How do the roots expand into the soil?

HOW A TREE GROWS

Roots

The roots of a tree are below the ground.

As a tree grows, its roots expand into soil. The roots grow at the very tips, expanding into new soil. In this way, the roots are very similar to the twigs!

It's necessary for roots to expand because as a tree gets older and bigger, it needs more nutrients and water. The only way to get more is to expand roots into new soil!

How a Tree Grows Summary

What We've Learned about:
How a Tree Grows

In this section, we discussed the following terms:

* Seedling
* Crown
* Trunk
* Roots
* Photosynthesis
* Bark
* Cambium
* Inner bark
* Wood

We also talked about the following concepts:

* All trees grow in pretty much the same way.
* Tree crowns grow taller so the tree can get enough sunlight.
* Tree trunks grow wider to support the size of the tree.
* Tree roots grow longer so the tree can get enough water and nutrients.
* New growth on roots and twigs occurs at the ends.
* Cambium cells, located between the bark and the wood multiply to make new bark and wood.

Well, that sums up our How A Tree Grows lesson. Next we will be taking a look at wood in the first part of "Wood Parts and Anatomy".

Continue to Next Section

Wood Parts and Anatomy

Taking a Look at Wood

Wood is like any other material -- it's made up of lots of different parts! Each part has its own job and function.
It's important to know what all of these parts do so we can know why wood has the properties it does.

All the pictures on this page probably look confusing now, but if you keep reading, you can find out what they all do!

First, let's look at two different kinds of wood.

**Wood Parts and Anatomy**

**Taking a Look at Wood**

**Hardwood and Softwood**
You've probably heard people talking about two different kinds of wood - **hardwood** and **softwood**.
Surprisingly, these names have almost nothing to do with how hard or soft their woods are! Many times, softwoods are harder than hardwoods!

The names hardwood and softwood have to do with the trees that the wood comes from.

___

**Hardwood** comes from *deciduous*, or hardwood, trees.

The tree on the right is a hardwood tree.

Decidous trees lose their *foliage* in the fall.

___

**Softwood** comes from *evergreen*, or softwood, trees.

The tree on the right is a softwood tree.

Evergreen trees keep their foliage all year.

___

When you look at softwood and hardwood very closely, there are many difference, but we'll talk about those in the "Taking a Closer Look at Wood!" section of this lesson.

Right now, we're just going to look at some of the basic features that all kinds of wood have.

[Some features of wood](#)

**Wood Parts and Anatomy**

**Taking a Look at Wood**

**Features of Wood**
When you look at the picture of wood below, you see some of the most obvious and important features in wood.

On the following pages, we will examine each these features in detail.

Heartwood and Sapwood

Wood Parts and Anatomy

Taking a Look at Wood

Heartwood and Sapwood
If you look at the cross-section of a tree trunk, many times you'll see a dark, inner region, called the heartwood and a lighter, outer region called the sapwood.

The sapwood is live wood and its main job is to carry water from the roots to other parts of the tree.
The **heartwood** is dead wood, but it used to be live sapwood! The heartwood's main job is to provide support for the tree. Heartwood also helps the tree by being resistant to insect attacks and decay.

So, if heartwood used to be sapwood...

**What happened?**

---

**Wood Parts and Anatomy**

**Taking a Look at Wood**

---

**Heartwood**

We said that wood. As we wood is of cells called sapwood.

As the new cambium, the no longer dies, it the center of

After it has changes that of water in the accumulate the heartwood and decay!

---

**Sapwood**

and **Sapwood** sapwood is the living, outer region of learned in "How a Tree Grows," new formed just inside the bark, by a thin layer the cambium. This new wood is new sapwood forms just underneath the sapwood closest to the center of the tree is needed and dies. When the old sapwood becomes heartwood, which is located at the tree.

died, the old sapwood undergoes some make it heartwood. Basically, the amount wood decreases and certain chemicals there. The chemicals that accumulate in are what makes it resistant to insect attack

---

**Growth Rings**

---

**Wood Parts and Anatomy**
Taking a Look at Wood

**Growth Rings**
If you look closely at a cross-section of wood, you'll notice that the wood has dark *concentric* circles starting in the center. These are called *growth rings* and each ring represents one year of growth!

You've probably seen growth rings before, but you can click on the picture at the right to get a closer look at these rings.

You may have noticed that growth rings are made up of a light and a dark area -- A light and a dark ring together make up one year of growth.

*Why are there light and dark colored rings?*

---

**Wood Parts and Anatomy**

Taking a Look at Wood

**Growth Rings**
The reason there are two colors in a growth ring is because they are actually two different types of wood!

The light wood is known as earlywood because the tree makes it in the early spring.

The dark wood is called latewood because the tree makes it in the late summer. (Easy enough, right?)

Determining the age of a tree is as easy as counting the growth rings!

*Let's get some practice!*

---

**Wood Parts and Anatomy**
Taking a Look at Wood

Growth Rings
We've magnified our picture from the previous page to make it easier for you to count growth rings. Each ring represents 1 year. Remember that it takes one earlywood ring and one latewood ring to make one growth ring.

Now that you know how it works, try counting the tree rings on the piece of wood below!

Finished?

Check your answer!

Wood Parts and Anatomy

Taking a Look at Wood

Growth Rings
The answer is 10.

Here's how:
Now that you’ve got the hang of it, let's take a look at a cross section of a whole tree and see how you do!

Tree Age Quiz

Wood Parts and Anatomy

Taking a Look at Wood

How Old is This Tree?
Let's see if you can use the skills you just learned in "Wood Anatomy and Parts" to figure out how old this tree is!
25 years old
50 years old
100 years old
You can't tell from this picture!

Let's continue our lesson...

Wood Parts and Anatomy
Taking a Look at Wood

---

**Knots**
I bet everyone has seen a knot in a piece of wood and wondered what it was... So, what exactly is a knot?

Knots are simply branches that the tree has either grown over or grown around.

We learned in "How a Tree Grows" that trees grow outward as well as upward. When they get bigger around, the tree has to grow either around or completely over a branch. The overgrown branch becomes the knot!

Take a look at the picture on the right. Can you see that when this piece of wood was part of a tree it had a branch growing out where the knot is? You can click on the picture to take a closer look.

Knots make whole pieces of wood weaker. So, wood with knots usually isn't as valuable! It's important to know how knots effect the properties of wood when making wood products. We will learn more about wood products in a later lesson.

**Bark**

Wood Parts and Anatomy

---

**Bark**
Bark is the first part of a tree that you see. It's the stuff that's on the outside of the wood.

You can click on the various pictures on this page to take a closer look!

Suprisingly, bark is not actually wood! Even though bark is not wood, it is a very important part of the tree, and deserves to be discussed in this section.
Bark does a number of important jobs for trees, but its main job is to protect the wood underneath! Bark is a tree's suit of armor!

Bark also prevents the wood from being scorched if there is a forest fire.

Bark can be thick or thin, it can be rough or smooth, light or dark, some bark even peels! Click on these pictures of hackberry and ash bark, and take a closer look!

Let's take a break, now, and review what we've learned so far about Wood Parts and Anatomy.

Wood Parts and Anatomy

Taking a Look at Wood

What We've Learned So Far:
In the this section, we talked about the following terms:

* Hardwood
* Softwood
* Deciduous
* Foliage
* Evergreen
* Heartwood
* Sapwood
* Concentric
* Growth Rings
* Earlywood
* Latewood
* Knots
* Bark

We also talked about the following concepts:
* Hardwood and softwood have nothing to do with how hard or soft wood is.

* Hardwood comes from deciduous trees.

* Softwood comes from evergreen trees.

* Wood has lots of parts that we can see with the naked eye, including heartwood, sapwood, growth rings, knots, and bark.

* Heartwood is the dead wood at the center of a tree. It's main function is to support the tree.

* Heartwood used to be sapwood.

* Sapwood is the living wood located between the hearwood and the bark. It's main function is to carry water and nutrients from the roots to other parts of the tree.

* You can determine the age of a tree by counting its growth rings; each ring represents on year of a trees life.

* One growth ring is made up of one earlywood ring and one latewood ring.

* Earlywood is the lighter part of a growth ring; it is formed early in the spring.

* Latewood is the darker part of the growth ring; it is formed late in the summer.

* Knots are formed when the tree grows over or around branches.

* Bark is not really made of wood!

Well, that sums up our the first part of our Wood Parts and Anatomy lesson. In the second part of this lesson we will be **Taking a Closer Look at Wood**.

Continue to Next Section

Wood Parts and Anatomy

Taking a *Closer* Look at Wood

When you look at the diagram of wood below, you can see some of the less obvious features in wood.
Don't worry if you can't pronounce some of these strange words, we'll teach you! We're going to discuss each of these parts of wood, and what their purpose is!

Phloem

Wood Parts and Anatomy

Taking a *Closer* Look at Wood

**Phloem**

Phloem (pronounced "flow-um") is the part of the tree that is located just inside the bark. As a matter of fact, phloem is commonly known as "inner bark"!

Remember when we said that bark was not actually wood? Well, phloem isn't actually wood, either! However, phloem is a very important part of the tree.

As you already know, the leaves perform photosynthesis to make food and sugar for the tree.

The phloem is what carries the sugars from the leaves at the top of the tree to the roots and other parts of the tree!

Cambium

Wood Parts and Anatomy
Taking a *Closer* Look at Wood

---

**Cambium**

The cambium (pronounced "cam-bee-um") is a very thin layer -- usually it is only one cell thick!

The cambium is located just inside the phloem.

The cambium's job is to make new wood cells.

When the cambium cells divide, the ones on the outside make new phloem (or inner bark) and the ones on the inside make new wood!

---

**Rays**

**Wood Parts and Anatomy**

Taking a *Closer* Look at Wood

---

**Rays**

Rays are easily seen in some woods, as shown in the pictures at the right.

However, in softwoods and most hardwoods, you can’t see rays without magnification.

Take a look at the picture of red oak on the left. This picture is magnified 12 times it's actual size. You can easily see the long, orangish rays in this piece of wood now, but you couldn't have seen them without magnification! You can click on this photo to get a closer look.

Although you can't always see rays with the naked eye, you can often see discolorations in the wood which are caused by rays.

The dark flecks in the piece of beech on the right are caused by rays. Click on the photo to get a closer look.

The lighter areas in the piece of oak on the left are also caused by rays. Click on the
Taking a **Closer** Look at Wood

--- **Xylem**

Xylem is the most important part of a tree's wood ... in fact, wood is totally made up of xylem!

When you're looking at a piece of wood, what you're actually looking at what is called xylem (pronounced "zi-lem").

The xylem's job is to carry water for the tree from the roots to other parts of the tree.

Not all xylem is alive and works. As we talked about earlier, heartwood is dead xylem. On the other hand, sapwood is live, xylem, is very important to the tree support and strength!

The heartwood, or dead tree. It's what gives the

So, wood is made up of xylem.

But, what is xylem made of?

--- **Xylem**

Xylem is made up of long, skinny cells called fibers. A good way to think of a wood fiber is to picture a straw.
A really good way to think of wood or xylem in a tree is to picture a handful of straws. The straws are like the fibers, sucking up water from the roots!

The picture of magnified spruce wood on the left clearly shows the straw-like fibers of xylem. Click on the picture for a closer look.

Not all xylem looks just like this, though. Spruce is a softwood, and this is a picture of softwood xylem ...

Hardwood xylem looks different

Wood Parts and Anatomy

Taking a Closer Look at Wood

Xylem
Hardwood xylem and softwood xylem have many differences!

One of the main differences in hardwood and softwood xylem has to do with very large cells called vessels. Hardwoods have vessels, but softwoods don't.

Here, take a look for yourself!

This first photograph is our picture of spruce (softwood) xylem from the previous page:

And this one is a picture of hardwood xylem:
Can you see the difference between these pictures? Those big dark circles in the hardwood xylem are called vessels!

Vessels are HUGE water-carrying cells! Notice how big the vessels are in comparison to the fibers!

Some vessels are so big they can be seen without magnification -- Look at the vessels in the piece of red oak on the right -- you can click on the photo to take a closer look. See the vessels?

The large, hollow vessels in red oak allow us to blow bubbles through red oak pieces.

You can blow bubbles with wood?!

**Wood Parts and Anatomy**

**Taking a *Closer* Look at Wood**

**Xylem**
Absolutely! But we need to use the right kind of wood.

We just learned that wood is made of cells (fibers) that look and act like straws and that trees use the straws to draw up water.

If we use the right kind of wood, we can blow bubbles through the vessels!

Just like all trees are different, the wood in the trunk is all different. In some trees, the wood straws (vessels) are plugged up!
Remember when sapwood changes to heartwood that things change? Well, one of those changes is that in some trees, some of the cells next to the vessels grow into the hollow part of the cell and plug up the cell so that water cannot flow anymore!

Let's see how this works.

**Wood Parts and Anatomy**

**Taking a *Closer* Look at Wood**

**Xylem**
The vessels (staws) in red oak are not usually plugged up with other cells. However, the vessels in white oak usually are plugged.

Below are pictures of wooden dowel cross sections taken with a microscope. Can you see the difference between the white oak vessels and the red oak vessels? You can click on the pictures to get a closer look.

![Plugged vessels](image1.png) ![Open vessels](image2.png)

white oak  red oak

This is a natural process in these two kinds of trees, but lots of other trees have this too, hickory and locust for example.

When we do our Bubbling Bazookas activity, we will use white oak and red oak so that we can compare them.

Let's make some bubbles and have some fun with soap for a change!

**Oh Boy, Bubbling Bazookas!**

Skip this activity.
Wood Parts and Anatomy

Taking a *Closer* Look at Wood

**What Have We Learned So Far?**

In the this section, we talked about the following terms:

* Phloem
* Cambium
* Rays
* Xylem
* Fibers
* Vessels

We also talked about the following concepts:

* Phloem is located just inside the bark, and is commonly called inner bark.
* Like bark, phloem is not really wood!
* Phloem carries sugar from the leaves to the rest of the tree.
* Cambium is located just underneath the phloem.
* Cambium makes new phloem on the outside, and new xylem on the inside.
* Rays radiate inward from the cambium to the center of the tree.
* Rays move sap to the center parts of the tree.
* Rays can cause dark or light discolorations in wood.
* Xylem is located just inside the cambium.
* All wood, including heartwood and sapwood, is made up of xylem.
* Xylem is made up of long, skinny, straw-like cells called fibers.
* Vessels are large water-carrying cells that run parallel to xylem fibers.
* Hardwoods have vessels; softwoods do not.
* Sometimes the cells next to vessels grow into the vessels, blocking them off.
* If the vessels are plugged you can't blow bubbles through them. ;^>

Well, that sums up our the second part of our Wood Parts and Anatomy lesson. Now it's time to take the great BIG ....

Wood Parts and Anatomy Quiz!

Wood Parts and Anatomy

Taking a Closer Look at Wood

Test your knowledge!

Use the information you learned in "Wood Parts and Anatomy" to answer the quiz questions below. Good Luck!

1. Which of the trees below is a Softwood?

2. Click on the heartwood below.
3. What causes knots?

☐ Sap stuck in the tree
☐ An insect wound
☐ An overgrown branch
☐ Rays
☐ Aliens

4. Which of the following statements about Phloem is true?

☐ Phloem carries water and nutrients from the roots to the rest of the tree.
☐ Phloem carries sugar from the leaves to the rest of the tree.
☐ Phloem protects trees from insect attacks.
☐ Phloem performs photosynthesis to make food and sugar for the tree.
5. What causes the lighter flecks in this piece of oak wood?
- Rays
- Xylem
- Knots
- Cambium
- Insects

6. What part of a tree makes new wood cells?
- Vessels
- Xylem
- Knots
- Cambium
- Bark

7. Which of the following is not made up of xylem?
- Heartwood
- Softwood
- Latewood
- Knots
8. What does this picture represent?
- Softwoods
- Xylem
- Rays
- Roots
- A very thirsty person

9. What are the large holes in this magnified piece of wood?
- Rays
- Vessels in hardwoods.
- Pockets of sap
- Vessels in softwoods.
- Insect wounds

10. How can you tell how old a tree was when it was cut down?
- Measuring the height of the tree.
- Measuring the width of the trunk.
- Counting the rays in a cross-section cut of the tree.
- Counting the growth rings in a cross-section cut of the tree.
Wood Parts and Anatomy Summary

Wood Parts and Anatomy

Taking a Closer Look at Wood

What Have We Learned about Wood Parts and Anatomy?

In "Wood Parts and Anatomy" we talked about all the different parts of wood, what they are called, and what they do.

We covered an awful lot of material, so take a minute to look back over the summary sections for Taking a Look at Wood and Taking a Closer Look at Wood.

If you don't understand all of the terms and concepts, ask your teacher to explain them.

We hope you enjoyed the Wood Parts and Anatomy Lesson of our show. Our next lesson is called "What's This?".

Continue to Next Section

Wood Products

How Wood is Processed

Lots of times, wood will be cut into boards and used as it is -- for hardwood floors, tables, chairs, etc. As an example, look at the table in the picture at the right.

But, lots of times, people will modify or change the wood before it's used. Think of the paper in all of your books -- that's wood, but it's definitely been modified! As examples, check out the book, construction paper, and toilet paper in the picture above -- that's all wood!
When wood is modified before it is used, we say that it is *processed*. Things made from processed wood are called **wood products**!

Some of the most important wood products we use everyday are *boards, plywood, paper, and particleboard*. We'll talk about how all of these wood products are made, and how they're used!

**Let's get started!**

**Wood Products**

**How Wood is Processed**

---

**Boards**

Boards are made by cutting logs from tree trunks into long, thin, and flat pieces that are often called *lumber*.

Boards are used to make hundreds of things from the walls, floors, ceilings, and roofs in our houses, to the furniture and cabinets we use everyday and baseball bats, golf clubs, pianos, clarinets, guitars, hammer handles, jewelry boxes, pencils, and lots of other things.

Boards are also used to make *pallets*. Pallets are used to ship boxes that contain the food we eat, clothes we wear, our school and office supplies, toilet paper, napkins, papertowels - the list goes on and on!

Let's go to the sawmill, and see in more detail how boards are made from trees!

**Oh Boy! A field trip!**

**Wood Products**

**How Wood is Processed**
**Hardwood Sawmill Field Trip**

You can click on the pictures on this page to get a closer look.

*Converting logs into boards is a pretty simple process that involves cutting boards from logs, squaring up the edges, and cutting the boards to the right length. This is done by hand in some parts of the world, but most of the lumber is produced in modern sawmills with lots of machinery. Let's take a trip through a hardwood sawmill and see how boards are made from trees...*

---

**First:**

Logs are brought to a **sawmill** on log trucks. Then logs are unloaded, sorted by species and **grade**, and stored in a **log yard**.

---

Logs are then brought to the **debarker deck**, where the bark is removed. The bark is removed because it is dirty and dulls saw blades! The individual logs are then conveyed to the **log loader/turner**.

---

**Second:**

Next is what is called the "**primary breakdown**". This is where the log is positioned on a moving **carriage** and passed through a single-edge **band saw**.
Then the log is cut into boards and *cants* or large timbers.

---

**Third:**

The next steps are called "*secondary breakdown". This is where the boards are *edged*, or cut to width, and trimmed to length. Boards go to *edger saws*, which cut edges off and square up sides.

---

Cants go to *gang saws* which cut the large timber into boards, some of these boards come back around to the edger saws.

---

Edged boards then go to *trimmer saws*, which trim them to the correct lengths.
Wood Products
How Wood is Processed

Hardwood Sawmill Field Trip
You can click on the pictures on this page to get a closer look.

The boards are then **graded** based on the number of clear, small pieces that can be cut from them. The grade and volume of each board is recorded on **tally sheets**.

Fourth:

Sorting, drying, and finishing.

Sorting: Boards are then moved to the "green chain" where they are stacked according to grade and length..

The board stacks are stored in **air dry sheds** and yards where they are left to dry for 2 weeks to 3 months.

Drying: The stacks are loaded in **dry kilns** where the boards are dried to a moisture level close to what the final moisture level will be; this takes from 7 days to 3 weeks depending on the kind of wood.

When the boards are removed
from the dry kilns, they are graded again and trimmed if necessary.

The dry lumber is stacked and sold as dried lumber.

Fifth:

Nothing is wasted in the conversion of logs to lumber! Sawmill residue such as edges, slabs, trimmings, and bark are chipped and sold to other companies that make paper and mulch and sometimes burned to produce heat at the sawmill.

Boards Summary

Wood Products
How Wood is Processed

What Have We Learned about Boards?

In the this section, we talked about the following terms:

* sawmill
* lumber
* pallets
* grade
* log yard
* debarker deck
* log loader/turner
* primary breakdown
We also talked about the following concepts:

* Boards are made from tree trunks.

* We use boards to make lots of things, including the houses we live in, furniture, musical instruments, and pallets.

* Most everything that we see and use every day has been shipped on a pallet.

* Boards are made at a sawmill.

* There’s lots of different equipment at a sawmill!

* All the leftovers from making boards are used somewhere! Most frequently the residue is chipped and sold.

Well, that sums up our boards lesson. Next we will learn about plywood.

What's plywood?

**Wood Products**

**How Wood is Processed**

---

**Plywood**

Plywood is one of the most widely used wood products. Its main use is in the construction of homes and buildings.

As we will see in "Daily Wood -- Everyday Uses of Wood in You Home," plywood is used underneath almost everything you see in a building. There's plywood *sheathing* under the floor, the walls, and the roof!
Plywood is so good to use because it's light-weight and strong. Plywood is also convenient to use because it comes in sheets, which are much easier to handle than boards!

But, what exactly is plywood?

Wood Products
How Wood is Processed

Plywood

Plywood is basically very thin sheets of wood glued together. Plywood is like a Wood Sandwich!

The thin layers of wood are peeled from trees. These layers of wood are called veneer!

The veneer is then glued together to make plywood.

If you'd like to imagine a piece of plywood, think of a grilled cheese sandwich!

Slices of Bread are like thin sheets of Veneer.

Cheese is like glue.
We said that one of the reasons plywood is so useful is because it is strong. Thin layers of wood aren't very strong. Glue doesn't seem very strong. So...

What makes plywood so strong?

Wood Products
How Wood is Processed

Plywood

Plywood is strong because of a property called stiffness. Stiff just means "hard to bend."

If you look closely at a piece of wood, you can see the grain. The grain is formed because of the way wood grows. As you can see, the grain only runs one direction. If you try to bend a thin piece of wood in the other direction, it will be difficult to bend; it's stiff.

Here's a quick experiment to help you understand!

All you need is a thick piece of paper, like a piece of construction paper.

Cut the paper in half, the short way.
Fold the two pieces up from one end to the other by bending them back and forth like you're making a fan. The folds in the paper are like the grain in wood.

Now, hold one piece of bent paper by the edges and try bending it. You will find that the paper is a lot harder to bend in the direction opposite the fold.

Your paper is stiffer perpendicular to the folds. Wood is stiffer perpendicular grain.

Now, hold your two pieces of paper together so that the folds are perpendicular to each other. You will find that your paper is stiff in both directions!

When we make plywood, we set each layer of veneer so that the grain runs the opposite direction of the previous layer. In this way, we make a relatively thin sheet of wood that is surprisingly strong!

Here's a picture of a cross-section of plywood. You can see that the grain runs in different directions on each layer.

It's also important to realize that glue used to make plywood is very strong! The glued joints can be stronger and stiffer than the original wood!

The plywood-making process

Wood Products
How Wood is Processed

Plywood

Making plywood has many steps, but it's an easy process to understand!
First, the logs are heated. Usually the logs are soaked in a bath of hot water. Soaking logs softens up the wood and makes it easier to peel.

Second, the logs are peeled into thin sheets of veneer. Imagine peeling the skin off of a potato -- only keep peeling until the potato is gone!

Third, the veneer is clipped, or cut into sheets the correct length and width.

Fourth, the sheets of veneer are dried. Warm air is blown onto the veneer sheets.

Fifth, glue is applied to the veneer. Usually, the veneer is on a moving belt underneath a box of glue. The box has a slit in the bottom, so glue falls down in a sheet onto the veneer. In this way, the veneer sheets are coated with glue!

Finally, the sheets of veneer are layered and pressed together in a large press machine. The machine not only presses the veneer layers together very tightly, but it also heats the glue so it melts and sticks the layers together very well!

When it comes out of the machine, you've got a finished sheet of plywood!

**Make your own "wood" sandwich!**
Well, ok, it's just a grilled cheese sandwich... but you get the idea!

**Skip this activity.**

**Wood Products**
**How Wood is Processed**

**What Have We Learned about Plywood?**

In the this section, we talked about the following terms:

* Plywood
* Sheathing
* Sheets (as in sheets of plywood)
* Veneer
* Grain
* Stiffness

We also talked about the following concepts:

* Plywood is mainly used in the construction of homes and buildings.
* Plywood is like a grilled cheese sandwich; the veneer is like bread, and the glue is like the cheese.

* Plywood is strong because we alternate the layers of veneer when we are making it so that the wood grain runs in opposing directions.

Well, that sums up our plywood lesson. Next we will learn about **paper**. Be careful! You may have "Wet Elbows" by the end of this lesson!

**Yea! Wet Elbows!**

## Wood Products

### How Wood is Processed

#### Paper

Paper is another one of the most common uses of wood. Think of all the ways we use paper everyday - newspapers, grocery bags, books, the paper we write on, cardboard boxes... the list goes on and on! Just look at the picture below to see some of the most common uses of paper we see everyday!

![Paper Uses](image)

Paper was invented in China about 2000 years ago! Even though it's been around for that long, it was a long time before people around the world started making paper.

Before there was paper, people used different things for recording words. For example, the ancient Sumerians used clay tablets! Not nearly convenient as paper - can you imagine how heavy a "book" made from clay tablets would be?!

Another good thing about paper is that it can be recycled! The fibers that make up paper can be used over and over!

[How is paper made?](#)
Wood Products
How Wood is Processed

Paper

Different kinds of paper are made in different ways. For example, you make writing paper differently than you make cardboard boxes.

However, paper is generally made in the same way. What you basically do is break down wood into very, very small particles and make a mat of these particles.

When you look at paper through a microscope, it looks something like this:

![Microscope Image of Paper](image)

Of course, making paper is a little more complicated than that...

The paper-making process

Wood Products
How Wood is Processed

Paper

Making paper has a lot of steps, but it's not hard to understand!
First, wood is broken into very small pieces (fibers), or pulp the wood. This can be done mechanically (usually with a stone grinder) or chemically.

Second, the fibers are suspended in water to be washed and/or bleached. Washing the fibers gets rid of chemicals that might still be on the wood. Bleaching the fibers makes the paper white. Not all paper is bleached--think of a piece of writing paper and a grocery bag. The writing paper is bleached, but the grocery bag isn't!

Third, The pulp is beaten. Beating the pulp unravels the fibers a little. This makes them stick together better. The pulp is beaten by putting it through two very close metal disks. The disks grind the fibers up.

Fourth, a slurry is made by mixing the wood pulp with water.

Fifth, the slurry is poured onto a screen forming a mat. The water drains away and leaves lots of fibers on the screen!

Sixth, since it's still a little damp, the paper has to be thoroughly dried. This is usually done by rolling the paper on big warm drums.

When the paper is dry, you've got finished paper!

Until the paper is used, it's stored on giant rolls. (They look like huge toilet paper rolls!)

Now let's make some paper ourselves!

Wood Products
How Wood is Processed

Making Your Own Paper

Making paper has many steps to it. For your convenience, we offer the instructions in two formats, so you can print them out:

PDF format (448 KB)
plain text format (13 KB)

The PDF version includes illustrations. If you would like this version, but do not have the software necessary to read it, you can download Adobe's Acrobat Reader here for free.
Before you begin, be sure you've read the section on "Wood Products: How Wood is Processed: Paper" to get an idea of what exactly paper is and see how paper is made in big paper plants. You'll be surprised how similar our methods of paper making are!

**Paper Summary**

### Wood Products

#### How Wood is Processed

**What Have We Learned about Paper?**

In the this section, we talked about the following terms:

* Pulp
* Stone grinder
* Slurry
* Drums

We also talked about the following concepts:

* Paper is used in many ways that are familiar to us all.
* Paper was invented in China about 2000 years ago.
* Paper can be recycled.
* Paper is made up of small particles of wood.

Well, that sums up our paper lesson. Next we will learn about **particleboard**.

*What in the world is particleboard?*

### Wood Products

#### How Wood is Processed

**Particleboard**

Particleboard is another one of the most commonly used products. Particleboard is used in furniture, cabinets, office furniture, home entertainment cabinets, and many other products!
Particleboard is made of small particles of wood compressed together with glue. The wood particles can be different sizes - anywhere from the size of a quarter to saw dust. If you look at the pictures below, you can see the small wood particles. Click on the pictures to get a closer look.

Where do all the particles come from?

Wood Products
How Wood is Processed

Particleboard

One of the neat things about particleboard is that it uses materials that would otherwise be thrown away!

The particles that make up particleboard are called *mill residues*. Mill residues are just pieces of wood leftover from wood processing.

Sawdust, wood chips, and wood shavings are examples of mill residues and can all be used to make particleboard.

Mill residue can come from *sawmills* or *chip mills*. Here's a picture of some particles used to make particle board; you can click on the picture to get a closer look:

Now let's take a closer look at how particle board is made...

The particleboard making process
Particleboard

Making particleboard has many steps, but it’s not hard to understand!

First, the first step in making particleboard is to get together a good and uniform mix of wood particles to use. You want to have a mix of different species and different wood dryness.

Second, the particles are prepared. They may need to be cut into smaller pieces, ground up or cut in a similar shape.

Third, the wood particles are dried. If they're not dry, the glue won't stick as well (you've probably seen how hard it is to glue wet stuff before).

Fourth, a glue mixture is sprayed onto the particles and mixed in well. By the way, the glue doesn't cover all the particles - the glue is so strong, it only has to be sprayed on!

Fifth, a mat is made out of the particles. Usually, the mat is made by pouring the glue and particle mixture onto a moving belt to a set width.

Sixth, the moving belt then takes the mat to a special press. This press presses the particles very close together and heats up the mat. The heat makes the glue stick better. The particleboard mat is pressed for a couple of minutes.

When the press opens, the particleboard is just about finished! After being cooled and sanded, you have particleboard!

Particleboard Summary

Wood Products
How Wood is Processed

What Have We Learned about Particleboard?

In the this section, we talked about the following terms:

* Mill residues
* Sawmills
* Chip mills
We also talked about the following concepts:

* Particleboard made up of small pieces of leftover wood.

* Mill residues can come from sawmills and chip mills

* Particleboard can be used to make variety of things including furniture and cabinets.

* The glue used to make particleboard is so strong that it doesn't need to cover every particle.

Well, that sums up our particleboard section and completes our wood products lesson. Let's take a quick minute to review what we have learned in this lesson.

**Wood Products Review**

**Wood Products**

**How Wood is Processed**

**What Have We Learned about Wood Products?**

In "Wood Products: How Wood is Processed" we talked about four common ways that wood is modified or processed before it is used.

We covered an awful lot of information, so take a minute to look back over the summary sections of Boards, Plywood, Paper and Particle board.

If you don't understand all of the terms and concepts, ask your teacher to explain them.

We hope you enjoyed the Wood Products section of our show. In our next lesson we are going to take a look around the house at wood and wood products we use everyday in "Daily Wood".

**Continue to Next Section**

**Daily Wood**

**Everyday Uses of Wood in Your Home**

Wood is one of the most useful and versatile materials available. We use wood in many different ways everyday!
Let's take a tour of this house to see some of the uses of wood and things made of wood. You'll be surprised at just how much wood we use!

Today you will use **three pounds** of wood! Can you guess how?

Let's take a look!

## Daily Wood
### Everyday Uses of Wood in Your Home

#### The Outside
When you look at the outside of a house, you see lots of wood at work! There's also a lot of wood that you don't see doing its job!

![Image of a house with annotations: Plywood is underneath the roof as roof sheathing. This deck is made of wood. Plywood is also underneath the shingles. This house has wood shingles.]

Let's look inside...

## Daily Wood
### Everyday Uses of Wood in Your Home

#### The Livingroom
When you come inside, you will see lots of wood in the house! There is flooring, furniture, window frames, and lots of other things!
What other wood is there in this picture? There's some things you can't see, but is right there! Like plywood *sheathing* underneath the walls, plywood underneath the floor, and the backing of carpet and upholstery.

Can you think of anything else? Remember that plywood is underneath almost everything!

Let's check out the kitchen...

**Daily Wood**  
**Everyday Uses of Wood in Your Home**

The Kitchen
When we go into the kitchen, there are many more wood products! plywood is still underneath everything! Don't forget about all the foods from trees in the cupboards -- nuts, spices, fruits, etc.

Let's look in the dining room...

**Daily Wood**

**Everyday Uses of Wood in Your Home**

---

**The Dining Room**

There's lots of wood in this dining room, too!
Daily Wood
Everyday Uses of Wood in Your Home

The Bedroom
When we go into the bedroom, there are still many wood products everywhere!

Let's look in the bedroom...
Do you see anything else made of wood in this picture?

Let's look in the bathroom...

**Daily Wood**  
**Everyday Uses of Wood in Your Home**

**The Bathroom**  
Even in the bathroom, there is lots of wood!
Wow! This whole house is full of wood!! Maybe it's hard to believe, but it's true!
Now it's time to take a look around your own house and see how much wood you can find!

**Daily Wood Scavenger Hunt**

**Daily Wood Scavenger Hunt!**

Print out this list and try to find all of these items around your house - you'll be surprised just how much wood you use every day!

* Photo film
* Rayon clothing
* Firewood
* Wooden furniture
* Apples, oranges or other fruits from trees
* Cardboard box
* Newspaper
* Hardwood floors
* Wooden musical instruments
* Pencil
* Tools with wood handles
* Charcoal
* Toothpaste
* Ice cream
* Vanilla extract
* Shampoo
* Toilet paper
* Cork board
* Salad dressing
* Wood doors and frames
* Picture frames
* Books and paper
* Cereal box

Now, let's review...

**Daily Wood**

**What Have We Learned About Everyday Uses of Wood in Your Home?**

In the this section, we didn't talk about any new terms, but we did see lots of wood everywhere in the house! Let's review:

*Outside* we found:

* plywood sheathing under the roof
* plywood under the siding
* shingle siding made from wood
* and the wood deck

In the *Living room* we found:

* wood flooring
* wood under the floor
* a wood picture frame
* a wood window frame
* wood floor and door molding
* a newspaper and magazines made from paper which comes from wood
* a rayon scarf and a tencel shirt; both made from wood products
* and a wood chair

In the *Kitchen* we found:
* spices which come from wood
* wood knife holders, knife handles and a cutting board
* a wood salt shaker, rolling pin and basket
* wood cupboards
* wood wall boards and ceiling boards
* a wood door with a wood wreath
* linoleum flooring which is made from a wood product
* cartons, dishsoap, and cellophand bags which are all made from wood products

In the **Dining room** we found:

* Lots of books!
* wood bookcase, table and chairs
* wood paneling, molding, framing and sheathing
* and a wood picture frame

In the **Bedroom** we found:

* wood sheathing
* carpet backing which is made from a wood product
* a wood bed frame, window frame, and mirror frame
* and a pillow made from rayon which is made from a wood product

In the **Bathroom** we found:

* facial tissue
* a wood picture frame, shelves, and a stool
* and hairspray, lotion, toothpaste, shampoo, vitamins, asprin and lipstick - all of which are made from a wood products!

My goodness, that's a **lot** of wood! What wood did you find in your own home?

**We also talked about the following concepts:**

* Wood is **everywhere**!
* We use three pounds of wood every day!
* Wood is underneath everything in our homes, including floors, ceilings, and walls.
* There's wood in the clothes we wear! (rayon, tencel)
* Lots of spices come from wood.
* Lots of cleaning products come from wood.
* Aspirin, vitamins, toothpaste, shampoo, hairspray, and lotion are all made from wood products.

Well, that sums up our Daily Wood lesson. In our next lesson, "Renewable Natural Resources", we will learn about why wood is such a good thing for us to use.

**Renewable Natural Resources**

Why Wood and Wood Products are a Good Choice!

One of the best things about wood and wood products are that they are made from **renewable natural resources**!

That's quite a mouthful -- What exactly is a renewable natural resource and why are they so great?

As for renewable natural resources, they're pretty easy to understand. Let's break the phrase up.

When something is **renewable**, it means that it can be replaced, or brought back. Trees are renewable because they grow back after they've been cut down. So if you manage your forests in the right way, you can grow back the trees you cut down forever!

When something is **natural**, it means that it comes from nature. Trees come from nature!

When something is a **resource**, it means that it's valuable to humans for making other things. Trees and wood are resources because there's lots of valuable things we can make from wood.

So, when you put the whole phrase together, a renewable natural resource is something that comes from nature that's valuable to people, and can be continually restored.

**Why would you want to use a renewable natural resource?**

**Renewable Natural Resources**

Why Wood and Wood Products are a Good
Choice!

There's lots of reasons to use natural renewable resources! Two good reasons are suggested by the name.

First, natural renewable resources are good to use because they are renewable.

Let's think about the gasoline we use in cars. Gasoline is a non-renewable resource, which means that we're going to run out! Someday, there won't be any gasoline left. We'll have to think of something else to use to run our cars!

If you use non-renewable resources, you're using something that cannot be replaced and will, one day, no longer exist.

Now let's think about trees and wood. Wood is a renewable resource. So long as we take good care of the forests, we will never run out of wood!

This brings us to an important point. You can't just use renewable resources any old way you want to and think it will always come back! You have to manage your renewable resources! Managing resources just means taking care of them.

For instance, managing forests and trees means that you have to take care of forest soils and water, harvest the trees correctly, and most times replant the trees you took.

In other words, renewable resources are renewable only if you take good care of them!

Of course, wood and trees aren't the only renewable resources; Wind, solar power, and hydroelectric power are other examples of renewable resources! So long as we manage these resources correctly, we will always be able to use them.

Another reason ...

Renewable Natural Resources
Why Wood and Wood Products are a Good Choice!
Another reason renewable natural resources are good to use is because they are natural.

Forests and trees are natural, and provide many benefits to all living things!

Trees help to clean the air all creatures breathe and the water all creatures drink.

Forests provide food and homes for birds, fish, deer, squirrels, and all kinds of life!

People enjoy forests for lots of reasons, including hunting, fishing, walking, camping.

People also use wood provided by forests in many ways, as we are learning!

Forests play a major role in why life exists on Earth! Many forms of life could not exist without trees and wood!

So, as you can see, renewable natural resources and wood and wood products are a good choice!

Some of the best reasons to use renewable natural resources are that, with proper management, they won't run out, and they also create a natural environment while they’re growing.

Renewable Natural Resources Quiz

Renewable Natural Resources

Why Wood and Wood Products are a Good Choice!

Test your knowledge!

Using what you learned in "Renewable Natural Resources", pick which of the following are renewable natural resources! Good luck!

- Wind
- Gas
- Wood/trees
- Solar Power
Renewable Natural Resources

Why Wood and Wood Products are a Good Choice!

What Have We Learned about Trees and Wood as a Renewable Natural Resource?

In the this section, we discussed the following terms:

* Renewable natural resource
* Non-renewable resource
* Solar power
* Hydroelectric power
* Manage (as in manage resources)

We also talked about the following concepts:

* Wood is a natural renewable resource.
* There are many natural renewable resources.
* Natural renewable resources are renewable only if they are managed properly.
* Natural renewable resources can be turned into energy that we can use.
* One day, we will run out of non-renewable resources and have to find alternatives.
* Beyond being a renewable resource, trees and forests provide food and homes for many kinds of life.

Well, that sums up our renewable natural resources lesson. Next we will be taking a look at what makes flexibility of wood in "Rock Stars".
Introduction

We have all heard people remark how strong wood is. That's a very true statement -- wood is very strong!

"Wood is very strong," that's a very broad statement. What exactly do we mean by strength?

Strength can be measured in so many different ways!

* How much can you compress the wood?
* What about pulling on the wood?
* What about everyday exposure to the elements?
* How about sudden impacts?

Being clear about how you measure strength in wood is very important because wood has to be strong in lots of different ways.

For example...

Examples of strong wood

Baseball bats are made from hickory. Hickory is a very hard wood and won't change shape or splinter when it receives a hard impact (like from a baseball).

Floors and stairs are often made from oak. Oak is a very dense wood and can endure the everyday walking and moving of people. A less dense wood would be worn away more quickly.
Power lines poles are usually made from pine trees. This is because they are strong enough to support the heavy lines. In addition, they have to be somewhat flexible, so when the wind blows the poles and they won't break.

Fence posts are made of black locust. Black locust is very resistant to decay because of chemical naturally found in the wood. Most other woods would decay with the constant exposure to the weather.

Railroad ties must be very strong, because everyday they are crushed by the weight of trains and cannot break.

As you can see, there are many different ways wood can be strong!

Many of the features that we discussed in "Wood Anatomy" can have an effect on wood's strength. Let's take a look...

**Knots**

**Rock Stars**

**Wood's Strength**

--- **Knots**

Knots can affect wood's strength. Take a look at "Wood Parts and Anatomy: Taking a Closer Look at Wood" lesson to review how knots are formed.

If you want very strong wood, look for wood without knots. Knots significantly reduce wood strength.

This doesn't mean that wood with knots is very weak -- knots just reduce the strength.

Knots reduce strength because they are a change in the direction of wood growth. When wood grows normally, all the cells grow in the same direction, but a know has cells that grow in a different direction. Knots interrupt the cells, so the cells become weaker!

Wood grain also has an effect on wood's strength.

**Wood Grain**
Wood Grain

One of the interesting things about wood's strength is that wood is not equally strong in all directions!

Wood fibers grow long-ways up and down along the tree trunk. The wood is very strong this way because of the fibers. We say that wood is stronger "along the grain," which is just a different way of saying "up and down along the fibers."

As you go sideways across the tree trunk, or across the grain, the wood is not as strong.

This means that if you need really strong wood, put the wood along the grain!

Now that we've discussed wood's strength a bit, let's test a piece of wood and see how strong it is.

Rock Stars

What Have We Learned About Wood's Strength?

In the this section, we talked about the following concepts:

* There are many ways that wood can be considered "strong" including how much it will elongate or compress.

* Knowing the way that a certain type of wood is strong means that we can use it more effectively.

* Knots make wood weaker.

* Wood is stronger along the grain, or up and down along the fibers, than it is across the grain.

Well, that sums up our Wood's Strength lesson. Next we will talk a little bit about trees, the mother of all wood, in "Trees are Great!".
Trees are great!

Plant a Tree!

Trees are great! One of the best things they do is produce wood, but trees do lots of other things you may not have thought of!

* Trees are beautiful! Look at some of the picture on the right!

* Trees can reduce air pollution. Dust particles collect on leaves, and not in our lungs!

* Trees reduce water pollution by taking up harmful chemical.

* Trees reduce soil erosion by holding soil in place with their roots.

* Trees create forests, which are home to many kinds of wildlife and birds.

* As you can see, trees are pretty amazing!

* With all the great things trees do, don't you think it's best to plant trees, and to plant them properly?

Tree planting tips
Trees are great!

Plant a Tree!

Tree Planting Tips:

Here are some tips to use and share when planting trees!

* It's best to **plant trees in the early spring**. This gives the tree a chance to grow new roots before the summer (trees need lots of roots for water in the summer).

* **Dig the hole for the tree 2-3 times wider than the roots**. This gives the roots lots of room to spread out.

* **Don't dig the hole any deeper than the roots**. Otherwise, the tree's base will get too wet when it rains.

* **Water your tree thoroughly once a week**.

* **Cover the ground underneath the tree with 4-6 inches of mulch**. The mulch will keep the ground from getting too hot or cold, reduce weeds, and keep more water for the tree!

Happy planting!

Now let's take a look at some

Trees are great!

Plant a Tree!

Amazing Tree and Wood Facts!

Trees and wood are amazing! Here are some fun facts you might not have known!

* The oldest known tree in the U.S. is a Western Juniper in California that's 4000 years old!
  
  *source: [American Forests](http://www.americanforests.org/)*

* The largest tree in the U.S. is a Giant sequoia in Sequoia National Park, California. This tree has a girth of 998
inches and is 275 feet tall!
source: American Forests

* In the U.S., there are about 747,000,000 acres of forested land -- that's about a third of the U.S.!
source: American Forest and Paper Association

* A wooden pencil can write about 45,000 words, or draw a line about 35 miles long!
source: The Pencil Pages

* The average person in the U.S. uses about 1600 pounds of wood every year!
source: Wisconsin Paper Council

* A healthy, mature tree has about 200,000 leaves!
source: Wisconsin Paper Council

* A cord of wood (a stack of logs 4 feet x 4 feet x 8 feet) could yield: 2700 daily newspapers; 4,300,000 postage stamps; or 7,500,000 toothpicks!
source: Wisconsin Paper Council

Well, that about covers our "Trees are Great" section. Next we're going to take a look at some critters that love wood so much they could just eat it up!

Continue to Next Section

## Termites

The picture on the right is of a termite. Which group do you think is most closely related to the termite?

- [ ] Ants, Bees, Cockroaches
- [ ] Dogs, Cats, Goats
- [ ] Earthworms, Caterpillars, Inchworms
- [ ] Stinkbugs, Beetles, Ladybugs

Why?
Termites

Why are ants, bees, and cockroaches closely related to termites?

* All of these insects are social insects. They take special care of each other within their family or colony.

* Termites are similar to cockroaches because they both lay their eggs, and have similar body parts.

* Termites contain a microorganism in their bellies, allowing them to digest wood; unlike ants and other insects.

* Termites have only one partner (husband or wife) throughout their life. They are very faithful to one another. Because of this, they have a very large, integrated family, whom all work together.

You've seen ants before, and probably seen flying ants as well. Termites are often mistaken for flying ants. Below is a picture of a termite and a picture of a flying ant. Which one do you think is the termite?

Can you see the differences?

Termites

The difference between flying ants and termites.

Flying Ant

Wings:
Front pair is longer than rear pair
**Body:**
Red, brown, black in color. Has 3 segments (body parts)

---

**Termite**

**Wings:**
Both pairs are equal in length

**Body:**
Black in color, non-segmented (Eastern Subterranean termite)

---

Flying ants might get in your sugar bowl, but termites will eat up the wood that supports your home!

*Check Your Home for Termites!*

## Termites

### Check your home for termites.

<table>
<thead>
<tr>
<th>Where to look</th>
<th>What to look for</th>
<th>What to do!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny window sill</td>
<td>Many dead termites</td>
<td>Show then to mom and dad, then vacuum them up!</td>
</tr>
<tr>
<td>Wood pile located near the house</td>
<td>Check that they are not crawling</td>
<td>Have mom or dad raise the pile off the ground and move the pile 18 inches</td>
</tr>
<tr>
<td></td>
<td>on the house</td>
<td>away from the house, while you clean up the dead leaves that are gathered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>under the wood pile or between the pile and the house.</td>
</tr>
<tr>
<td>Basement or garage (dark, damp areas-look high and low!)</td>
<td>Look for mud &quot;tunnels&quot; or <strong>shelter tubes</strong> that the termite uses to crawl and work in.</td>
<td>Immediately show mom and dad the shelter tubes and tell them they need to call the exterminator!</td>
</tr>
</tbody>
</table>
There are several kinds of termites in the United States. Next we will discuss how you can determine which kind of termite is most likely in your area.

**Termites in the USA**

## Termites

**Termopsidae** or rottenwood termites

* Located in various places out West.
* Largest termites in North America.
* Do not live in the in the ground.
* Nest in rotten wood, creating large *galeries*

**Kalotermitidae** or drywood and dampwood termites

* Located mostly in Florida.
* Nest in damp or dry wood, creating galleries and eating all debris in the way.
* Able to live under arid, or dry, conditions.
* Often distributed in furniture or other wooden materials, making them difficult pests.

**Rhinotermitidae** or subterranean termites

* Located throughout the USA.
* Live mostly in the ground, sometimes above ground if it is humid
* Make shelter tubes of soil materials, mixed with saliva and fecal matter
* Eat wood by following the grain and eat the earlywood first.

**Termitidae** or higher termites
* Located mostly in Arizona and California.
* Have a bacteria in their bellies rather than a micro-organism
* Comprise three quarters of all described termite species
* Often eat plant litter, grass, and dung, along with wood
* Considered mostly harmless, and not known to cause structural damage.

Termites

Termite Families

As we said earlier, termites have very large families. Each family member has specific chores. Termite families are broken up into four major groups: workers, soldiers, reproductives, and of course the Queen!

WORKERS:

* Most abundant
* Responsible for feeding nymphs, soldiers, and reproductives
* Dig tunnels
* Locate food and water
* Build and repair nests
* garden mushrooms

SOLDIERS:

* Develop from nymphs
* The metamorphosis into this type takes two moults
* Possess specialized defensive weaponry
* Provide colony defense against predators

REPRODUCTIVES:

* Some of these are winged, called Alates. Others lose their wings, called Dealates
* Swarm during certain times of the year
* Starts the family

QUEEN:

* She is cleaned, fed, and attended after, by the King
* She is immobile and dependent on the workers
* She can produce thousands of eggs a day
* She can be up to ten centimeters in length!
Now that we've met the family in general...

Let's meet Tommy, the Wood Magic Termite!

Termites

Tommy the Termite

Those of you who have attended our Wood Magic Show have gotten the chance to see a termite up close and personal ... and I mean really up close!

During this event we look at Tommy through a scanning electron microscope which allows us to see Tommy as much as 1200 times his original size!

We're going to do the same thing here! Help us take a really close look at Tommy by clicking on the "Grow Tommy, GROW!" button.

Photographs of termites courtesy of Carlisle Price

Let's take a look at some other pictures of Tommy!

Termites
Tommy the Termite

Here are some more close up pictures of Tommy the Termite. You can click on the images to enlarge them.

Photographs of termites courtesy of Carlisle Price
**Termite Summary**

**Termites**

**What Have We learned About Termites**

In the this section, we talked about the following terms:

* social insects
* microorganism
* shelter tubes
* galleries
* workers
* soldiers
* reproductives
* queen
* nymphs
* mouls
* alates
* dealates
* swarm
* scanning electron microscope

We also discussed four kinds of termites:
* Termopsidae
* Kalotermitidae
* Rhinotermitidae
* Termitidae

We also talked about the following concepts:

* Ants, bees, cockroaches are closely related to termites.

* Termites are social insects.

* Termites have a microorganism in their bellies which allows them to digest wood.

* Termites only have one partner throughout their life.

* Termites are often mistaken for flying ants.

* All termites eat wood.

* If termites are in your home, they could eat up the wood that supports your home!

* Termites can be found in many places around your home like sunny window sills, wood piles, and damp dark places.

* There are four kinds of termites commonly found in the United States.

* Termites have large families, each of whom have specific chores.

* Termite queens can produce thousands of eggs in a day and can be up to ten centimeters in length!

This is the end of the activities and lessons included on the Wood Magic Website. You can go to the Site Map to skip around between Activities or click here to return to the Home Page.