



Learning to Use Wood

How do trees become the wood we use for making things? For some products, the logs can be used almost as they come from the tree. Telephone poles, fence posts, and firewood need little manufacturing. For most of the wood we use, the logs are cut into lumber or made into plywood, particleboard, or fiberboard. The type of tree the wood comes from, how it is cut, and how it is treated after cutting affect how it can be used—and even whether it can be used—for a particular project.

You learned in Unit I that trees can be divided into two basic groups. We call these **hardwood** and **softwood** trees. Hardwoods have broad, flat leaves; examples are oak, maple, and cottonwood. They usually turn color and lose their leaves in the fall. Softwoods have needle-like or scale-like leaves; examples are pine, cedar, and fir. They usually keep their leaves through the entire winter.

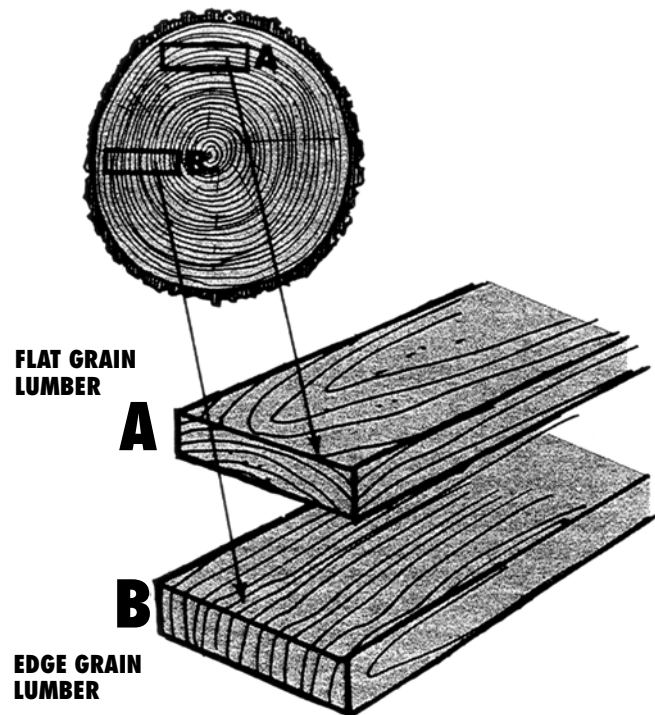
These names may fool some people into thinking that the wood from a hardwood tree is always hard, and the wood from a softwood tree is always soft. In fact, this is not always true, but the names remain because it is true in many cases.

The wood from hardwoods and softwoods is used for different things. Hardwoods are often used to make furniture, flooring, and paneling because of the attractive grain and colors. Softwoods are more often used as lumber or plywood for general building construction. For your project, you probably will use softwoods because they are usually available at local lumberyards. Hardwoods may be harder to find. Discuss with your leader or helper the various woods that are available and have them help you select the best wood to use in your project.

Let's look at wood to see how other things might affect its use. If we look at the cut end of a branch, log, or stump, we will see rings surrounding the center. They look like a target or bullseye. Each year a tree grows, it adds a new ring. This is why they are called **annual rings**. You also can see the annual rings on the cut ends of lumber.

The annual rings not only show on the ends of lumber, but they continue up the length of the board and appear on the faces and sides. They will appear as bands, lines, or other patterns. It is these annual rings that give wood its attractive patterns when cut and finished. On the faces and sides of wood, we call the annual rings and their patterns the "grain" of the wood. Look at a piece of lumber and see how the annual rings form patterns on the surface.

When a sawmill cuts a log into lumber, it may be cut in several ways. If you cut the log off center, closer to the edge like "A," you get **flat grain** lumber. The



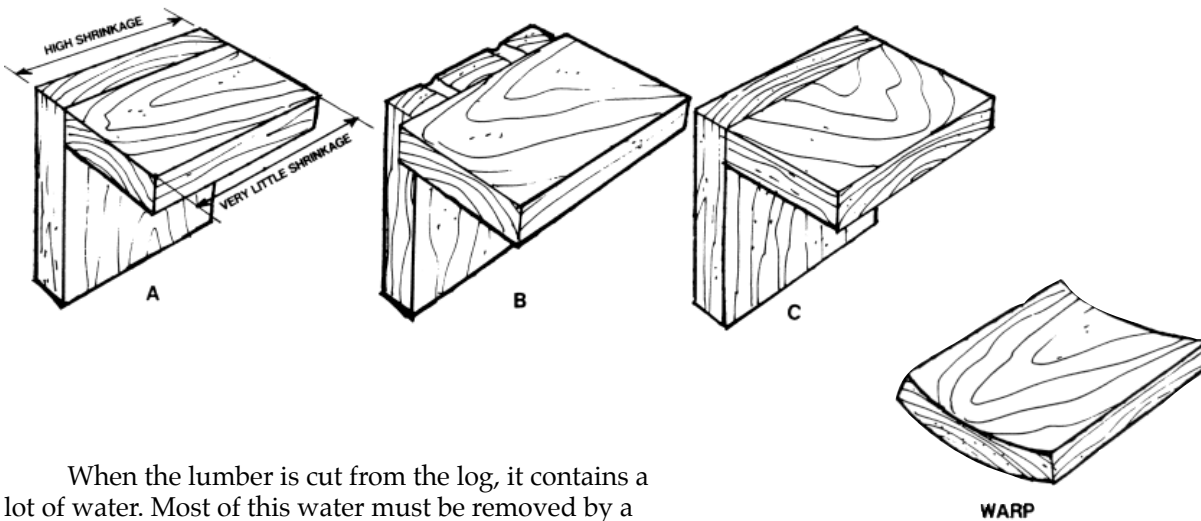
grain on the wide face of the board will be large, flat bands; long, wavy arches; or long patches, depending on how the saw cuts through the annual rings of the log. The grain on the edges will be narrow stripes or lines.

If the log is cut through the center like "B" in the drawing, you get **edge grain** lumber. In edge grain lumber, the grain goes nearly straight across the board from top to bottom and gives a pattern of stripes or lines on the wide face of the board. Lumber cut near the center of the log has edge grain.

Something for You to Do

Find a tree stump or a round piece of firewood, or ask your parent or leader to help you cut a piece from the end of a log or tree branch. Count the annual rings to see how old that piece of wood was when it was cut.

Remember that the rings go all the way around the trunk, so count only from the center to the bark. If the stump or log is old enough, you may even be able to find rings corresponding to some of the important dates in your life, the life of your family, or the history of your community. You may also want to use annual rings and the history they tell as a demonstration in your 4-H club meeting.



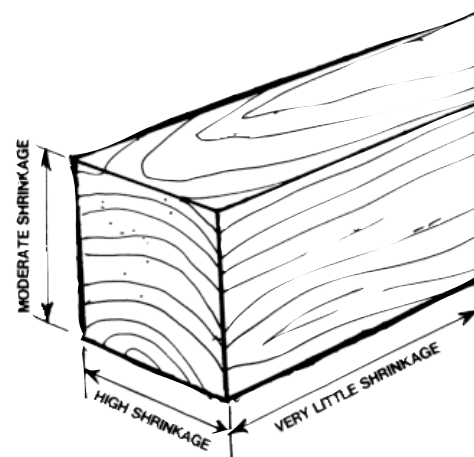
When the lumber is cut from the log, it contains a lot of water. Most of this water must be removed by a wood-drying process before the wood can be used, or the water eventually will evaporate, causing the wood to shrink. Some sawmills stack the lumber outdoors to let the water evaporate. This is called **air drying**. When complete, the lumber is called **air-dried** lumber. Others put the lumber in special buildings called dry kilns and heat the lumber to speed dry. Lumber dried like this is called **kiln-dried** lumber.

Some of the water in lumber evaporates without changing the size or shape of the wood. The amount of water that remains in the wood depends on the temperature and the **relative humidity** of the air around the lumber. Relative humidity is a measure of the moisture that is in the air. If the relative humidity of the air increases, the wood slowly gains moisture from the air, which causes it to swell. If the relative humidity of the air decreases, the wood loses moisture to the air and shrinks. These changes are always taking place, but if the wood has been dried properly and is protected and used correctly, the changes will be small and should not affect your project.

When wood shrinks and swells, the change in size is not the same in all directions. Wood shrinks and swells most in the direction along the annual rings. Along the grain or lengthwise to the piece of lumber, shrinkage is very small. Wide and thick boards shrink more than thin and narrow boards.

When we build projects, we must be careful to use wood correctly so that shrinkage and swelling do not hurt our finished product. Pieces put together like "A" (above) end up split and of different sizes (like "B") because the wood did not shrink the same amount. The proper way of joining these two pieces is shown in "C." Here the two pieces of wood will shrink and swell about the same.

When wood loses moisture or picks up moisture, it sometimes changes shape. This is called **warp**. Edge-grain lumber does not warp as much as flat-grain lumber.



Lumber that has been dried is better to work with than lumber that is **green** or wet, because it does not shrink or warp as much as green or wet lumber. Green lumber is lumber that has not been dried.

For projects that will be kept inside a house or building, drier lumber is needed than if the project is to remain outside. Check with your leader or parent for help.

The size of lumber is called its **dimensions** or measurements. The dimensions tell you the rough size of lumber when it was originally sawn at the sawmill. A 1 x 4 (one by four) is 1" thick and 4" wide when cut. As you know, lumber shrinks when it dries. Some material is also removed when the wood is planed smooth. As a result, most lumber cut 1" thick will end up being about $\frac{3}{4}$ ". A board cut 4" wide will be only $3\frac{1}{2}$ " wide after drying and planing. The original sawn size is still used to describe the piece, so it is called a 1 x 4.

The same thing happens to a 2 x 8 (two by eight). It is 2" thick and 8" wide when sawn. After drying and planing, it will be $1\frac{1}{2}$ " x $7\frac{1}{4}$ ", but it still is called a 2 x 8.



Plywood

You were introduced to plywood in Unit I. Plywood is made by gluing together three or more thin layers of wood called veneer and laying the grain of each piece at right angles to adjacent pieces. This gives the plywood extra strength and reduces shrinking and swelling.

Plywood is normally sold in sheets 4 feet by 8 feet (4 x 8). It comes in many thicknesses. It is measured in inches and sold by thickness. (For example, plywood called $\frac{3}{4}$ " plywood is $\frac{3}{4}$ -inch thick.) Unlike lumber, 1" plywood is 1 full inch thick.

Plywood is made in two types: (1) exterior type, and (2) interior type. The type refers to the glue used between the plies. If your item is going to be used outdoors, be sure to get exterior-type plywood, or the plies will come apart when the plywood gets wet. For indoor use, buy interior type plywood because it is less expensive for the same grade surface.

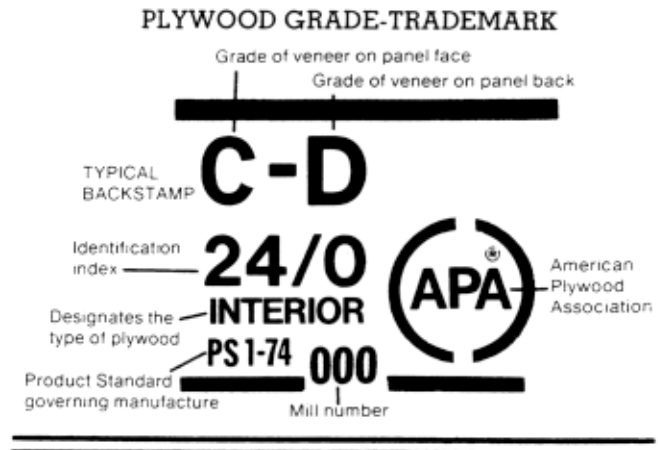
Many different species of trees are used to make plywood. Most of the softwood plywood comes from either Douglas-fir or southern pine.

The grades of softwood plywood are based on the quality of the veneer. The standard grades of veneer are A, B, C, and D, with A being the highest grade and D being the lowest. In the lower grade, more knots and defects will be present; however, these defects have little effect on strength.

Both sides of the plywood sheets are graded and do not have to be graded the same. If a sheet of plywood is graded A-D, the face will be A grade and the back will be D grade. In this manner, we can get greater use out of the high-grade logs than we could if all plies were required to be grade A throughout.

Interior-type plies usually have D veneer on the inside plies. Exterior-type plies must have C or better veneer throughout.

If you are building a project where both sides will show, you want to use an A-A plywood. If only one side will show, you can use A-C or A-D panel. You sometimes can cut pieces with clear faces from lower grade plywood by cutting between the defects.



Mill-Certified or Shop Grade Plywood

Some plywood is sold as mill-certified plywood. It also may be called shop plywood or shop cutting panels. This is plywood that has some defects that keep it from being sold as a standard grade. Mill-certified or shop plywood is found most often in areas where plywood is made. This is in the southern and western coast states. It may not be available in areas that are a long way from plywood plants. Mill-certified and shop plywood costs less than standard-grade panels. Many good, small pieces of plywood can be cut from mill-certified panels. These can be used for your woodworking projects.

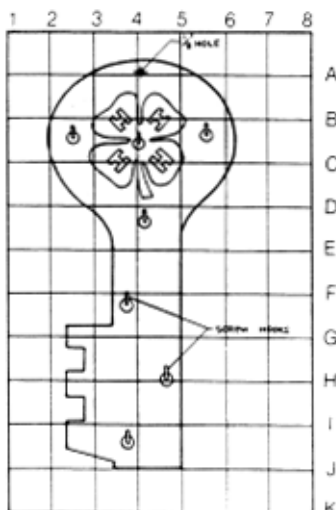


How to Use the Grid System

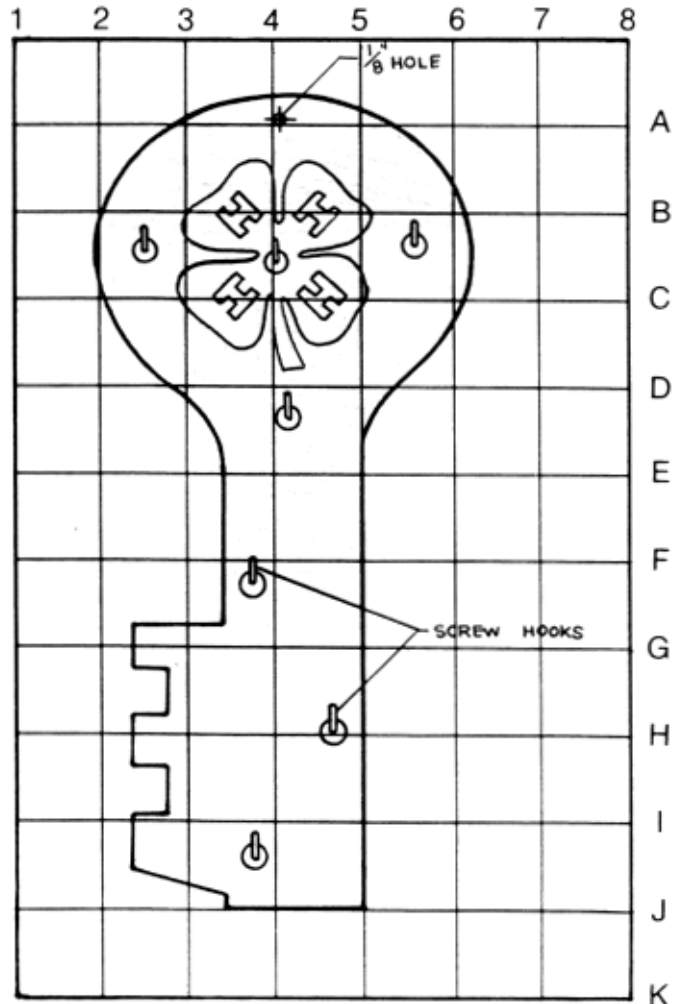
You may want to learn how to use the grid system to make drawings of irregular-shaped articles. The grid system is used to enlarge irregular-shaped drawings that are too small for a trace pattern.

For instance, if you had a 2" x 2" drawing of this key hook holder and you wanted to make it larger, you would follow these steps:

1. Decide on the size you want your pattern to be.
2. Draw a grid on your original article, and draw a grid the size you want your pattern to be on a clean piece of paper or wood. Both grids must have an equal number of squares, but the larger the drawing the larger the squares. The new drawing will then be your pattern.
3. Along one side number the lines. Place letters of the alphabet along the other. Remember, the squares on both grids must be identified the same.
4. Now you are ready to draw. On your original drawing, place dots where the outline of the picture crosses the grid lines. Transfer these dots to your new grid pattern, plotting the points one by one and connecting them in order as if you were trying to draw the picture free-hand. Use straight lines and curved lines where appropriate. As you connect the dots, your new pattern should be the same shape as your original, only larger.
 - To make a 12" x 12" drawing, use 12 rows of 1" squares.
 - To make a 16" x 16" drawing, use 16 rows of 1" squares or 8 rows of 2" squares.
 - To make a 24" x 24" drawing, use 24 rows of 1" squares or 16 rows of 1½" squares.



Original Pattern.



New Enlarged Pattern.