

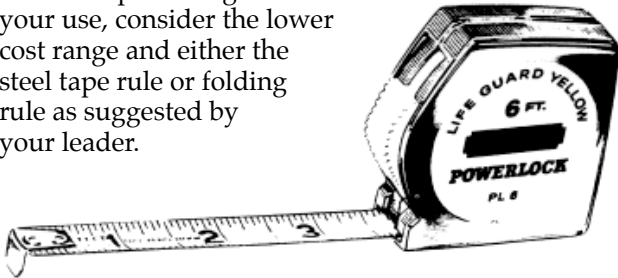


Woodworking Tools

Wood Science Unit I contains information about a group of tools and some equipment you should have for your use. This unit contains information about more tools. You may want to add some of them to your tool set.

Steel Tape and Folding Rule

In this unit, you will be making bigger things than before. Therefore, you may desire a steel tape rule or a folding rule. Both are available in similar price ranges. For your use, consider the lower cost range and either the steel tape rule or folding rule as suggested by your leader.



The steel tape rule is available in many lengths: 6, 8, 10, and 12-foot lengths. The 6-foot length probably is adequate for your use.



Folding rules are available with either standard inside reading or outside reading. The numbers on the inside-reading rule begin on the inside face. Thus the markings are close to the work when the rule lies on the work with the unfolded portion up.



Scratch Awl

Now that you are doing more exact and accurate work than before, you may need a scratch awl for marking. It gives a very clean, sharp, distinct line for accurate cutting. It can be used to make a center point in wood for drilling.



Attention Awl Users

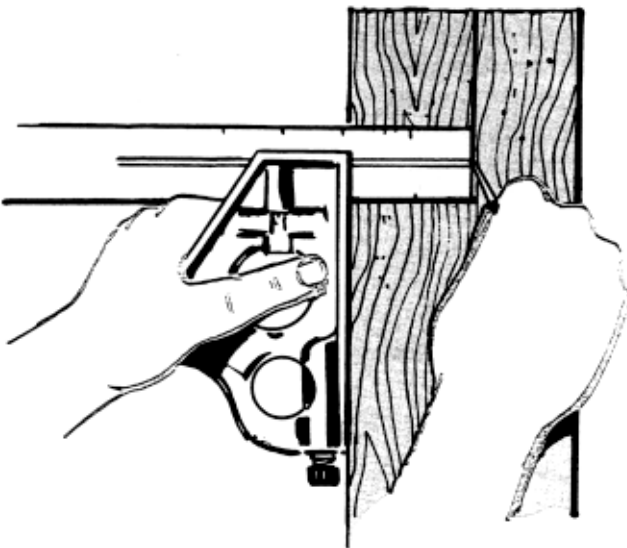
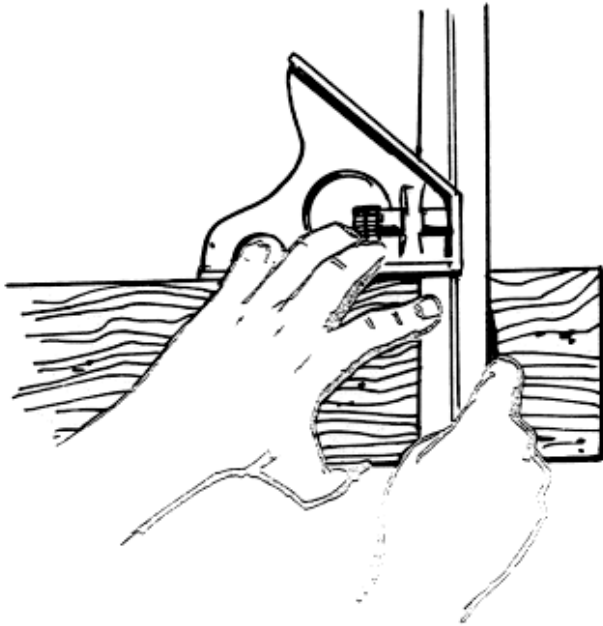
An awl is sharp-pointed like an ice pick. It is used for marking lines or piercing small holes in wood. Because of its sharpness, it must be handled carefully at all times so it won't pierce your skin.



Combination Square

A steel combination square and a scratch awl marker or pencil can be used to make a line of uniform distance from one edge of the wood piece.

Set the blade of the square in the desired position and securely tighten the adjusting nut. Hold the square firmly against the edge of the wood. Slide the handle along the edge of the wood piece with one hand while marking at the end of the blade with the other hand. Slant or slope the marker in the same direction as you are moving the square.



Pencil Compass

A moderately priced pencil compass works well for drawing circles or parts of circles. The pencil should be adjusted so that when the compass is closed, both the pencil point and the needle-like point of the leg are the same length. To use the compass, push the needle-like point into the center spot of your circle and move the compass in a circular motion. Slightly lean the compass in the direction you are moving.

When drawing a circle on a piece of paper, place a piece of cardboard or wood under the paper. Otherwise, the needle point may go through the paper and harm a nice tabletop.

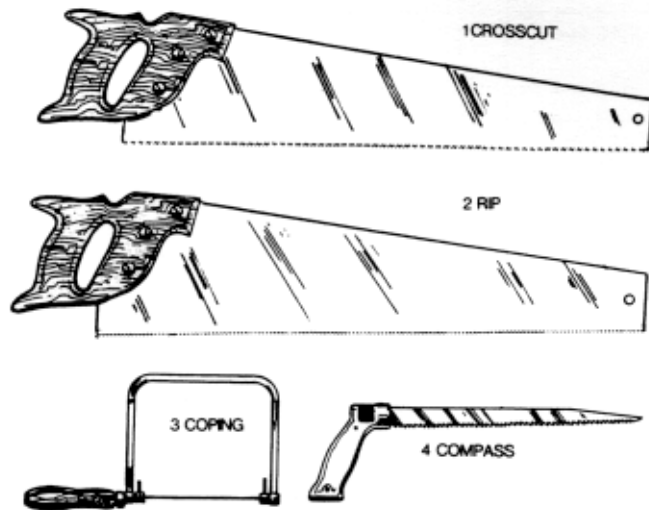
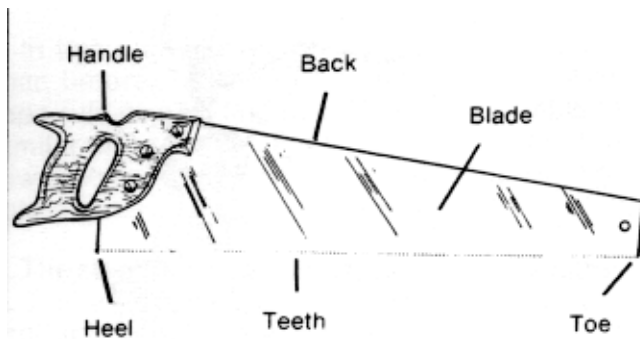




Hand Saws

Saw size is determined by the length of the blade in inches. Some popular sizes are 20", 22", 24", and 26". The coarseness or fineness of a saw is determined by the number of teeth points per inch.

There are different types of hand saws, each suited for a particular job.



Crosscut Saw

This saw is used frequently by woodworkers. Crosscut saws cut across the grain of wood, and they cut on both the forward and backward strokes. They are available with coarse teeth or fine teeth. The teeth have knife-like points.

A coarse, crosscut, 8-point saw works well for fast work and for green wood. A fine saw, 10 to 14 teeth points per inch, is better for smooth, accurate cutting and for cutting dry wood.

Rip Saw

Rip saw teeth are shaped like chisels. They cut like a gang of chisels in a row. The rip saw cuts mostly on the forward stroke and is used for cutting with the grain of the wood.

Coping Saw

This saw is used commonly for cutting curves in wood. It is small with a narrow blade and cuts better on wood that is not too thick, such as 1/4" to 1" thick. As the saw cuts, it tears and breaks the wood fibers, cutting in the direction that the teeth are pointing. For example, if the blade is placed in your saw with the teeth pointing toward the handle, the saw will be cutting on the pull stroke.

Compass Saw

This saw is small with a short, narrow blade. It is used to saw curves in wood too thick for a coping saw. To start an inside cut with the saw, you must bore one or more holes large enough to admit the point of the saw. Insert the saw point in the hole and cut with smooth, even strokes.

Crosscut Saw Teeth



Rip Saw Teeth





Attention Power Saw Users

Wear safety goggles whenever using electric saws.

Keep a firm grip on the saw so it does not jump out of your hands.

Turn the saw off and unplug it when cutting is finished.

Do not let the blade touch any part of your body. It can inflict serious damage.

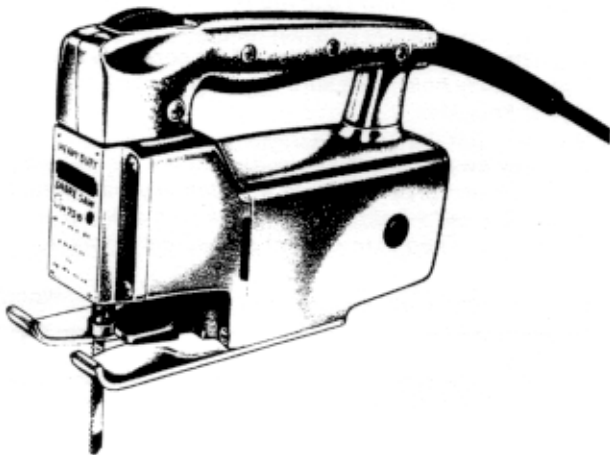
Use with supervision.

Power Saws

Saber Saw and Jig Saw

These power saws cut straight lines, curves, circles, and irregular shapes. Blades are available for these saws that can be used to cut metal, plastics, composition board, rubber, etc.

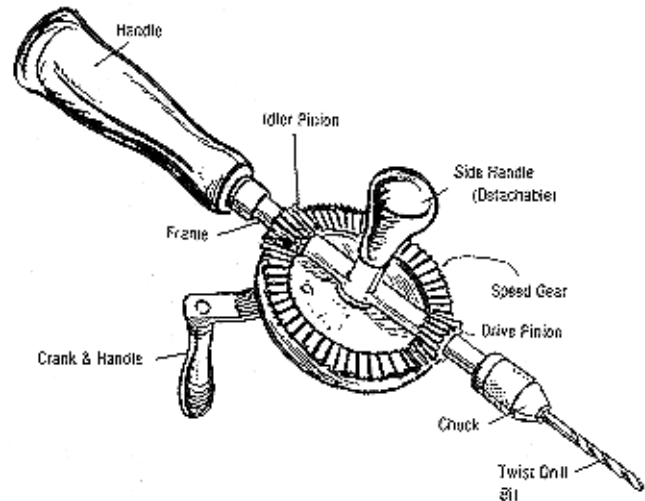
It would take many pages to explain in detail the operations of these saws. If you have one of them, study the instruction book you received. Operate power saws only with the supervision of a leader or parent.



Tools for Boring Holes in Wood

Hand Drill

The hand drill is used with removable drill bits of different sizes. It is used to make small pilot holes up to 1/4" for nails and screws. This prevents splitting the wood. Use it also to drill a starting hole for the coping saw blade.



Before you start drilling, make a small starting hole in the wood with a scratch awl or a nail and hammer. The hole prevents the drill point from slipping or sliding. Always make sure you have the right size drill bit properly placed in the chuck before you start to work.

To put the drill bit in the chuck, hold the crank handle and frame with one hand and turn the chuck to the left with the other. Open the jaws only a little more than the size of the drill bit. This helps to center the bit. Turn the chuck back to the right to tighten and hold the bit in place. The drill is used by holding it straight up and down. Hold the handle in your left hand and turn the crank with the right hand.

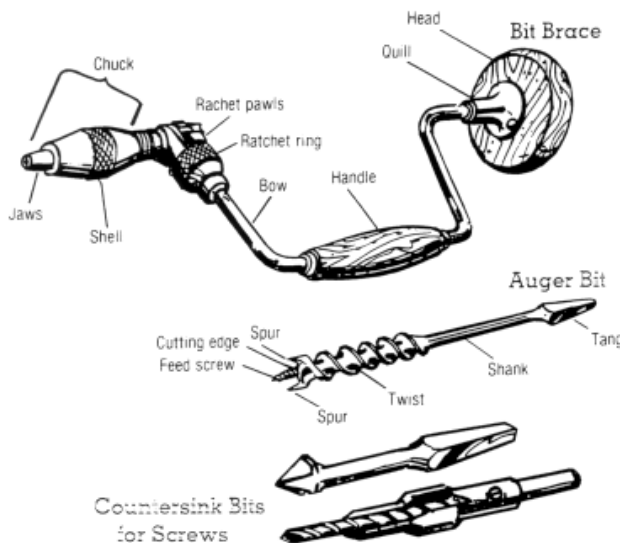
Proper Use of Hand Drills

Be careful. The drill may be jerked out of the wood and injure you. The gears also can pinch.



Bit Brace and Auger Bits

To bore large holes ¼-inch and larger, use your bit brace and auger bit or electric drill and appropriate bit. The bit brace is used for turning such tools as wood auger bits, screwdriver bits, twist drill bits, and countersink bits. Braces are made either with or without the ratchet device. The ratchet makes it possible to bore holes where the handle cannot be turned all the way around, as in corners. The size of a bit brace is designated by its sweep. The sweep is the diameter of the circle through which the handle swings. A brace with an 8- to 10-inch sweep is suitable for average work.



Can you see the similarity between the hand drill and this tool? They are both used to bore holes. However, on the hand drill the part that makes the hole is called the **twist drill bit**. On this tool it is called an **auger bit**. You can use either for making small holes, but it is easier to make large holes with an auger bit.

The bit and brace is used by pressing down on the head and turning the handle. As the feed screw starts to break through your item, turn the item over and finish boring the hole from the other side. This prevents splitting and splintering.

Most hardware stores sell auger bits individually or in sets. The number usually stamped on the tang (shank) indicates the size of the bit by 16ths of an inch. For example, 4 indicates ¼" or 1/4".

Brace and Bit Safety

This is a fairly safe tool, but accidents can happen. Hands have been pinched where the handle or head bearing became worn. Don't use the brace if it is badly worn.

Make sure the tang of the bit fits correctly and the chuck jaws firmly hold it. Be sure the ratchet won't slip and scrape your knuckles.

Stay away from the back side of the piece being bored. The bit can break through accidentally with great force. If possible, put a board on the back side of the piece you are drilling to keep your project piece from breaking.

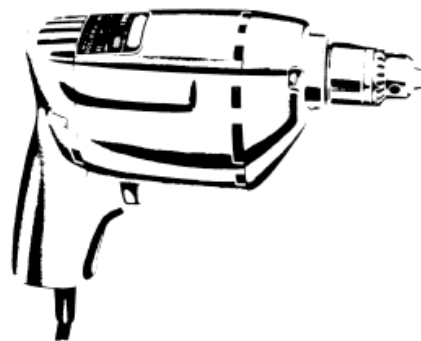
Electric Drill

The electric drill can be used for all sizes of holes, depending on its size and your ability to safely use it. A small electric drill is a very handy tool for drilling holes up to ¼ inch, and larger electric drills using special bits can drill holes up to 1 inch in diameter.

When using the electric drill, make a pilot hole in the wood the same as you would when using a hand drill. Always make sure you have the right size drill bit properly placed in the chuck before you start to work.

Drills are available in the light-duty, inexpensive range, medium-duty, heavy-duty, or industrial class. Electric drills also are available with varying speeds.

Electric drills run at a very high speed. When using the electric drill, grasp the handle firmly. The drill develops a twisting force called **torque** when in motion. If the bit suddenly became stuck, the torque of the drill could jerk your arm enough to strain a muscle.





Electric Drill Users

Always make sure the key is removed from the chuck before pressing the switch.

There may be a sudden twisting force on the drill handle should the bit become stuck. You must have a firm grip on the drill handle at all times.

Never use the electric drill where there is the possibility of touching water or in damp conditions.

Any slight break in the electric-cord insulation could give you a severe shock.

The wood being drilled should be clamped or held securely.

Keep the tool in good condition at all times.

Carbon steel drill bits work well in wood, but high-speed drill bits are necessary for drilling in metal. Metal is considerably harder than wood; therefore, carbon steel bits become dull very quickly when used in metal. The higher quality steel used in high-speed bits makes them more durable than carbon steel bits.

Wood Screws

There are various kinds and sizes of screws. The flat-head screw is used most commonly in woodworking, although the oval-head and the round-head screws are sometimes used, mainly for ornamental effect. The pan-head screw also is used.

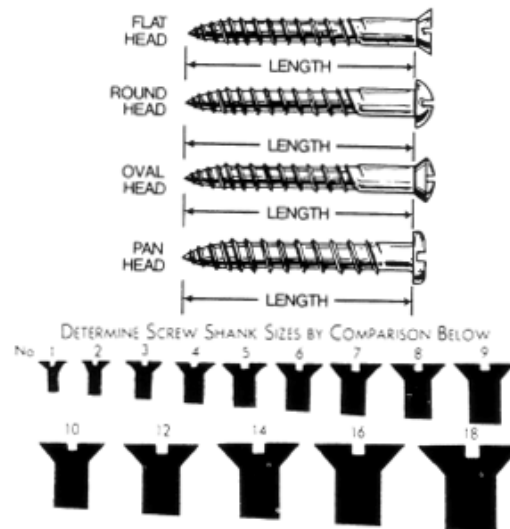
The size of wood screws is designated by:

- (1) Size of the shank
- (2) Length

You may use screws to assemble some of the things in your woodworking project. Remember to drill pilot holes to prevent splitting and to make the screws turn more easily.

To make pilot holes, find the proper drill size from the table. Drill the first hole as deep as the length of the screw from the head to the beginning of the threads. Then drill the second hole inside the first hole and drill as deep as the screw length. Instead of using two different-size drills to make pilot holes, you can buy combination pilot hole drill bits in a variety of sizes to fit the different-size screws.

Wood Screws



Sizes of Bits or Drills to Bore Holes for Wood Screws

Number of Screw	1	2	3	4	5	6	7	8	9	10	12	14	16	18	
Body Diameter of Screw	073	086	099	112	125	138	151	164	177	190	216	242	268	294	
	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{15}{64}$	$\frac{17}{64}$	$\frac{19}{64}$	
First Hole	Twist Drill Size	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{1}{4}$	$\frac{17}{64}$	$\frac{19}{64}$
	Auger Bit Number						3	3	3	3	4	4	5	5	
Second Hole	Twist Drill Size		$\frac{1}{16}$	$\frac{1}{16}$	$\frac{5}{64}$	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{13}{64}$
	Auger Bit Number											3	3	4	



Using the Screwdriver

Turn the screw in until the two pieces of wood fit tightly together. If you turn the screw too much, the wood around the screw threads will break out. Then the strength of the screw is lost.

The screwdriver should be the same width as the slot on the screwhead. It should be thick enough so it fits snugly into that slot.

Screwdriver Users

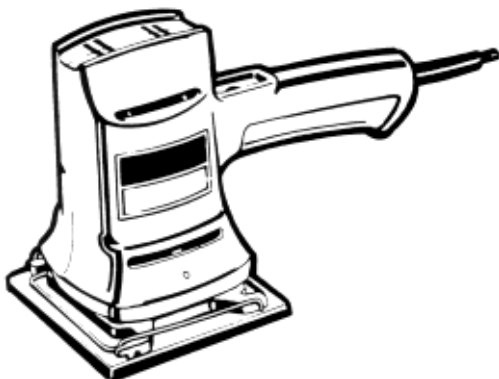
Imagine! Some people have been seriously hurt while using screwdrivers when the screwdriver slipped and struck them in the palm of the hand.

Objects you are working on should always be placed on the work surface. Never hold the object in the palm of your hand.

Screwdrivers must fit the slots of the screws properly.

Oscillating Sander

Oscillating electric sanders can be used in the shop and home. They can be used for paint removal, refinishing furniture, finishing wood and smoothing wood, wallboard, or plaster wall joints. The sanding action is provided by a rectangular piece of sanding paper attached to a sanding pad. The pad oscillates either back and forth or in a circular motion. A sander that oscillates in a circular motion may not be satisfactory for fine work, because it may leave circular scratches on the wood surface. If you are not sure whether to use this sander, ask your leader or parent for help.



Using the Sander

Be sure the sander is properly grounded through a three-wire grounding cord. Check to see that the switch is in the OFF position before connecting the electric plug to the outlet. Lift the sander off the work before starting or stopping it. Hold it firmly with little or no downward pressure. The weight of the sander is enough in most cases.

To smooth a rough surface, start with a coarse sandpaper because it cuts faster. Change to medium and then to fine sandpaper as the surface becomes smooth. Remember to sand along the grain (along the length of your wood piece), never across the grain.

Lubricate the sander according to recommendations of the manufacturer.

Using the Electric Sander

Because moisture conducts electricity, never use the electric sander in wet conditions. You can get shocked!

Unplug the sander when changing the sandpaper.

Never let the moving sandpaper touch the power cord. It can quickly ruin the insulation, which can then shock you.