UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Kentucky 4H Wood Science Plans Notebook

includes

Tool Safety and Project Plans

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INSTRUCTIONS TO THE WOOD SCIENCE PROJECT LEADER

This Ky. 4-H Wood Science Plans Notebook[1] provides safety guidelines on tool usage and a selection of plans to supplement other Wood Science Project literature such as the older National 4-H Wood Science Series[2] and the newer 4-H CCS Woodworking series[3].

The safety material is divided into 5 sections covering tools that parallel the youth's advancement through the project. Have the youth study each section and practice tool usage on sample materials to show proficiency in using the tools. Test the youth's knowledge with the quizzes. Answers are provided so you can grade the quiz. Discuss any wrong answers and improper operation with the youth until you are satisfied they understand the correct operation and use of the tools. This procedure of safety instructions assures that each youngster has had instruction in proper use of the tools to be used in the Wood Science Project.

The second part of the notebook provides numerous plans for you and the youth to choose and build items compatible with their desires and experiences. The plans are grouped into four levels that progress in size, complexity, tool usage and skill required for construction and completion. Have the youth select and progress through the various levels as they gain knowledge and skill in tool usage and wood material construction. Copies of plans can be printed from the electronic file or duplicated from a paper copy provided each County Extension Office for use by the youth during construction and finishing.

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[1] Revised by George Duncan, Teri Dowdy and Joyce Peel, Biosystems and Agr. Engr. Dept., Oct. 2003, from original material by George Turner, et. al.. Reviewed by Lloyd Saylor, Ext. Agent for 4-H Youth Development, Butler Co., Ray Wilson, Extension Agent for Ag. & Nat. Resources, Leslie Co., Frank Hicks, Ext. Agent for Ag. & Nat. Resources, Clark Co. Re-typing of text by Carla Humphrey, student assistant, 4-H Y. D. Dept.

[2] Units 1, 2, and 3 on UK CA/CES web site: http://www.ca.uky.edu/agc/pubs/4hpubs.htm , and Leader's Guide (Limited supply of Leader's Guide available).

[3] New National Wood working Literature: Levels 1, 2, 3, 4 and Activity Guide, order from: http://www.n4hccs.org/4h/shop/products.asp?action=list&cat=6&subcat=36

REFERENCE MATERIALS FOR THE LEADER IN 4-H WOOD SCIENCE

The references given herein are for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

The Ky. 4-H Wood Science materials are designed to supplement other Wood Science literature and provide broad learning experiences including practical application of technical information. However, it is recognized that the leader with a keen interest in woodworking and highly motivated 4-H youth may want to broaden their experiences and knowledge even more. The following list of references and sources of information is provided for your use and guidance of 4-H youth desiring more information about woodworking, finishing tools, wood technology, and related materials.

Check your local library, school, lumber suppliers and retail stores, and the internet for additional bulletins on woodworking, construction plans, wood finishing, and related topics in wood science.

SECTION I: PRINTED MATERIALS, VIDEOS, AND GRAPHIC PRESENTATIONS

1. BOOKS- the following books may be available from your local library, book stores or internet book sources.

   Making Toys With Plywood – Grete Peterson (www.walden.com or www.amazon.com)

   Creative Wood Design – Ernest Rottger (www.walden.com or www.amazon.com)
   Making Wooden Toys- Rolf Shutze
   Wood Design- Donald Willcox
   Fun With Tools- William Moore and Robert Cynar
   Making It Yourself-Simple Wooden Toys- Fred Haslam
   Make It and Ride It- C.J. Maginley (www.walden.com)

2. MAGAZINES – The following magazines have dimensioned plans in wood science:

   The Family Handyman
   235 East 45th
   New York, New York 10017

   Popular Science
   355 Lexington Avenue
   New York, New York 10017

   Popular Mechanics
   575 Lexington Avenue
   New York, New York 10022

   Home Craftsman
   Home Craftsman, Inc.
   8700 South Paxton Street
   Chicago, Illinois 60617

SOURCES OF OTHER EDUCATIONAL MATERIALS

Albert Constantine and Son, Inc. 2050 Eastchester Road Bronx, New York 10461 800/223-8087 www.constantines.com	Catalog of supplies & tools from around the world and wood carving kits., etc.
American Plywood Association APA - The Engineered Wood Association 7011 So. 19th, Tacoma, WA 98466 (253) 565-6600 / Fax: (253) 565-7265 www.apawood.org	Trade association providing resources from plywood to engineered beams
American Wood Council 1619 Massachusetts Ave., NW Washington, D.C. 20036 800/890-7732 www.forestprod.org/awc	Pamphlet "Some Little Known Fact About Wood," Leaflet "A Reader's Guide to Wood Products."
American Paper Institute 260 Madison Avenue New York, New York 10016 212/340-0600 www3.packexpo.com	"How You Can Make Paper" Movies available.
Mastercraft Plans www.grampas workshop.net	"Popular Plans and Patterns" Grampa's Workshop – Woodworking, Woodworking Projects.
National Particleboard Assn. 18928 Premiere Ct. Gaithersburg, MD 20879	Booklet- "The Story of Particleboard" one free copy
Southern Forest Products Assn. Pine Council P.O. Box 641700 Kenner, LA 70064-1700 504-443-4464	Write for a free copy – Southern "Everything You Always Wanted to Know about southern Pine and Ought To." A catalog of consumer technical and educational literature, films and services.
Weyerhaeuser Company Box A Tacoma, WA 98401 (206) 924-3915	Free kit of reference materials for leaders. Movies write or call for latest films and their description. Free

	use of film "To Touch The Sky" 28-minute full color 16 mm describes how man and science combine to grow more and better trees in endlessly renewable crops to produce for continuing demand for wood products.
WOODWEB, Inc RR4 Box 265A Montrose, PA 18801 www.woodweb.com/	Extensive info on wood products fasteners, tools, equipment, etc.
USDA Forest Service Forest Products Laboratory One Gifford Pinchot Drive Madison, WI 53726-2398 www.fpl.fs.fed.us/welcome.htm	Research reports and data on wood technology.

SECTION II - WOOD FASTENERS, JOINT FABRICATION, AND FINISHES:

Nails:
History of Nails: www.fourshee.com/history_of_nails.htm
Manufacturer of Nails: www.mazenails.com/

Screws:
Info on various screw types: www.aaronswoodscrews.com

Bolts:
Info on various bolts: www.boltdepot.com

Adhesives (Glue):
Types of commercial wood adhesives: www.gp.com/chemical/wood.html
Survey of wood adhesives: www.fnr.purdue.edu/PubsOnLine/fnr154.pdf
Making strong wood joints: www.dixieline.com/woodjoint/woodjoints.htm

Finishes:
Info on wood finishes: www.woodworker.com/Finishing_Adhesives.htm

SECTION III – SAFETY MATERIAL

"Power Tools," Rural Accident Prevention Bulletin No. 699.41-1, National Safety Council, Chicago, Illinois, 1977, pp. 1-4.

General Safety Guidelines for Woodworking Tools

It has been said that two things separate the human from all other animals—the brain and the hands. The human, using the hands, is capable of very intricate manipulative work. Yet, literally thousands of tools have been designed by the human to further this ingenious capability. The main reason for these tools is that through their use, the human has greatly increased the force that can be applied to objects. Some hand tools, especially sharp cutting edges, can apply thousands of pounds of pressure per square inch.

A second reason tools have been invented is that they can provide much more accuracy than the human hand.

However, it is the increased force of which tools are capable that causes us to be concerned with safety awareness. Here is a fact to be remembered. Always, when forces are greatly multiplied, there is increased potential for severe damage to be inflicted on the human body. If forces are kept low there is correspondingly less chance of damage. Since these great forces are needed to increase the work done by humans, great care must be exercised so that accidents won't happen.

USE THESE FORCES WISELY SO THEY WORK FOR YOU, NOT AGAINST YOU.

Your hands are the most valuable tools in the world but they cannot think for themselves. Your brain must do that. Your eyes are especially susceptible to injury because they don't have a tougher protective skin like the rest of your body. If an eye injury does occur, the eye may not be able to repair itself as the skin can. Use eye protection whenever it is suggested. High noise levels can be a problem when using some power woodworking tools. Under these conditions, use hearing protection.

Always learn about new tools from the instruction manual, leader and/or a parent before using the tool.

DON'T EXPERIMENT WITHOUT SAFETY!

Safe actions can become habitual. The safe habits you learn now will stay with you all your life and can be valuable in everything you do.

Remember, these safety guidelines are only the first steps in learning to use a tool safely. A thorough knowledge of the proper operating procedures is essential along with practice in developing the coordination and skill required in using the tool. Before using any tool you should follow these five steps:

1. Read the safety instructions
2. Take the quiz and discuss any wrong answers with your leader or parent.
3. Learn the proper operating procedures through instructions from your leader or parent.
4. Initial operation of the tool should be done with your leader or parent present to instruct and assist you.
5. Always check with your leader or parent each time you use a power tool or when attempting a new procedure.

(Protective equipment appropriate for use with woodworking tools—goggles, full-face shield, dust mask, acoustical earmuffs (hearing protection), ear plugs.)





Quiz on General Safety Information for Woodworking Tools

Note: Each 4-H youth should study and discuss the general safety guidelines with their leader and then complete this safety quiz, which will be graded by the leader.

The purpose of this quiz is to insure that the student has been exposed to specific safety points and is familiar with safe operating procedures for the tools to be used on a project.

1. The most valuable tools in the world are the human hands. (T or F) _____
2. Your hands can be taught to think and reason. (T or F) _____
3. One reason tools were invented is to increase the force of human hands. (T or F) _____
4. Following safe procedures can become a habit. (T or F) _____
5. You should not experiment with unfamiliar tools, regardless of size, but be checked out on their correct operation. (T or F) _____
6. The cutting edge of many small tools exert very high pressure and if improperly used can inflict severe injury to the human body. (T or F) _____
7. None of the safety principles concerned with woodworking can be applied to other activities. (T or F) _____
8. Your hands are the only part of your body, which you need to be concerned about when working with wood. (T or F) _____
9. The only reason tools have been invented is to increase force. (T or F) _____
10. As the force capability of tools increases so does their potential danger. (T or F) _____

Safety Guidelines for Hand Tools

This group of tools is the first you will probably use as you start activities in the woodworking program. If these tools are handled properly there should be no accidents. Study these safety Guidelines then take the quiz and be sure you are familiar enough to start using them safely.

ANY OTHER TOOLS NOT COVERED IN THIS DISCUSSION SHOULD BE THOROUGHLY EXPLAINED BY YOUR LEADER BEFORE YOU USE THEM.

Awl- An awl is a sharp pointed instrument very much 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 you. Secure the work to be pierced to a workbench top and push or point the awl away from you.

BRACE AND BIT- The brace provides leverage for twisting a variety of auger type bits for boring holes in wood. The main points of safety are to see that all bearing surfaces are in good working order so your hands will not be pinched. Do not have any part of your body past or behind the work since the bit could suddenly break through with great force causing severe injury.

CHISEL- This tool can be dangerous because the sharp edges cuts into the wood with intense pressure at the sharp edge. Never let the direction of this force be toward you because it might slip.

Tiny wood chips can be sent flying away at high speed. You should wear eye protective safety goggles or a full-face shield.

DRILL, HAND - You may not realize it but you can get hurt on these drills. The hand drill may be jerked out of the wood and swing sideways with the result that the bit can tear into you. Be careful of the gears on the hand drill. These can pinch.

COMPASS AND/OR DIVIDERS- This tool is used for marking circular areas or transferring measurements.

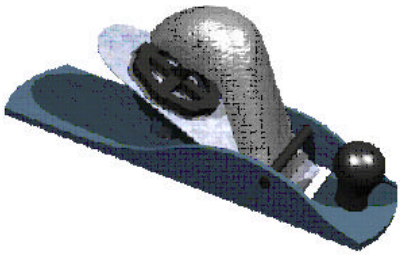
Because of the sharp points it must be handled with great care. On some models you can be pinched if the legs come together accidentally.

HAMMER- These hit with great force and that is what makes it a useful tool and also a dangerous one. Be especially alert when using a hammer. Watch when you draw the hammer back for a blow because the sharp claws could hit someone on the drawback. Do not hit one hammer with another hammer as the faces are hardened and could break sending sharp fragments at very high speed into your body. Hit the target flat so the hammer won't tend to slip sideways.

Loose hammerheads are extremely dangerous. Due to centrifugal force they can fly off on the down stroke.

PLANE-These tools are used to smooth boards. They come in various sizes but all are similar and operate on the same principle.

A very sharp edge chisel juts out just below the flat smooth bottom of the plane. Contact with this blade could cause an injury. Hold the plane with both hands and be sure wood is held securely and will not move. Never attempt to plane small pieces while holding them in your hand.



PLIERS- With your handgrip you can exert a force of 2,000 pounds on the wire cutting edges of the pliers. If you are cutting the tip ends of small nails or ends off wires these small pieces can fly through the air at tremendous speed and could cause an injury, especially to your eyes. Your fingers or hand can be severely pinched if the pliers slip off the work. Pliers with a worn and slipping hinge joint or jaws should be discarded.

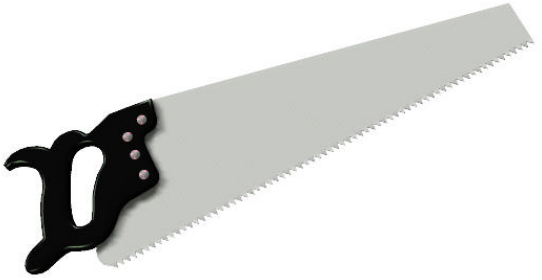
RASP AND FILE- Lots of painful injuries have occurred to people while using a rasp or file. The most serious were those when the tool was being used with no handle and the sharp end (tang) jabbed into the palm of the user's hand. Check those handles. Make sure they are in place.

Keep file teeth clean. Clogged teeth can cause unexpected slipping leading to an injury.

SCREW DRIVERS- Some people have been severely injured while using a screw driver. The usual injury is for the blade to jab into the palm of the hand that is holding the piece with the screw. Work pieces should never be held by hand. A vise or pliers should be used. If the screw driver properly fits the screw the chances of slipping are much less.

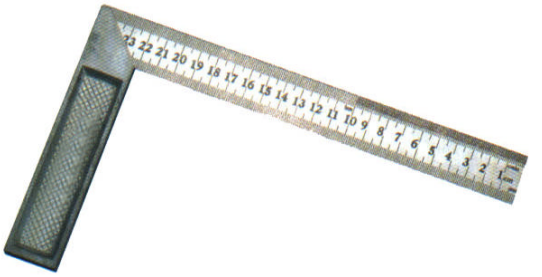
HAND SAW- A saw cuts because there is intense pressure at the tip of each tooth that is in contact with the wood. Each tooth acts as a miniature chisel. Handle the saw safely so that its teeth never touch human skin. This high pressure can rip through human flesh. Also, remember that sawdust is very slippery and can induce accidental falls. Sweep it up often.

Many serious injuries occur when the saw jumps while starting a cut. Never place your hand near the saw cut in an attempt to guide the saw. If help is needed in positioning the saw for starting the cut, use a square wooden block.



SCALES, TAPES, AND FOLDING RULES- These measuring tools appear to be fairly safe, but some bad injuries have occurred in their use. The flat metal scale (top) has fallen from a high shelf, the roll rule (center), lying on edge on the floor, has cut a youngsters bare foot and the folding rule (bottom) can pinch and even break fingers. The end of a self-winding tape can whip around causing serious injury. Watch these innocent looking tools.

SQUARE- This tool is used for marking angles of various sizes, most generally the 90°. It is similar to the steel scale in that it is somewhat difficult to hang up. Serious injury can be inflicted if it falls.



Safety Reminders:

1. Work in a well-lighted area.
2. Caution others to stand back and away from the area of operation.
3. Keep the work area cleaned up to avoid slips and falls.
4. Use appropriate eye and other personal protective equipment when required. Other persons in the immediate area should also have eye protection.
5. Be sure the tool is in good working condition and sharp to prevent accidental slipping.
6. Use the tool only for its intended purpose.
7. The direction of operation should always be away from you so a slip will not result in an injury to you.
8. When possible, secure the work so that it will not slip during operation.
9. Never use a tool while standing off balance or in an awkward position.

Safety Quiz for Hand Tools

Each 4-H member enrolled in the woodworking program should study the safety Guidelines on hand tools then complete this quiz and have it graded by your leader before using the hand tools.

1. Normal use of the hand saw puts intense pressure on each tooth that is in contact with wood. (T or F) _____
2. Using the thumb against the saw to guide it is inviting a serious accident to occur. (T or F) _____
3. The best place to leave saw dust is on the floor. (T or F) _____
4. Using a file or rasp without a handle is inviting serious injury. (T or F) _____
5. The injury caused by files is usually caused by the sharp end (tang) jabbing into the hand. (T or F) _____
6. Clean file teeth can help prevent files form slipping unexpectedly and causing injury. (T or F) _____
7. Hammers must hit with great force to drive nails into wood. If this force is misdirected serious accidents can occur. (T or F) _____
8. Drawing a hammer back to start its swing toward a nail is not a dangerous situation. (T or F) _____
9. It's O.K. to use a hammer to drive the claws of another hammer under the head of a nail. (T or F) _____
10. Using a damaged hammer is economical and safe. (T or F) _____
11. Centrifugal force can cause improper fitting heads to fly off hammer handles. (T or F) _____
12. A plane is such a safe tool you cannot be hurt by it. (T or F) _____
13. A tool such as dividers or compass must be handled as carefully as an ice pick. (T or F) _____
14. Most injuries inflicted by screwdrivers are because the object being worked on is held by hand. (T or F) _____
15. Making sure the blade of the screwdriver fits the screw properly can reduce the possibility of slipping and a serious accident. (T or F) _____
16. Measuring tapes and scales are so simple they cannot cause an accident. (T or F) _____
17. Pliers allow your hands to apply many hundreds of pounds of force to objects but this force cannot hurt you. (T or F) _____
18. Worn pliers should be discarded. (T or F) _____
19. A square is another simple tool that cannot hurt you. (T or F) _____
20. The awl deserves caution just like an ice pick. (T or F) _____
21. A brace and bit is another safe tool that never causes accidents. (T or F) _____
22. Chisels are dangerous because they cut with intense pressure at the sharp edge of the blade. (T or F) _____
23. The hand or punch drill are very safe because they are hand driven and cannot cause injury. (T or F) _____

Safety Guidelines for Light Duty Power Tools

Most light duty tools are portable and develop relatively low power and are easy to operate. Because they are electric powered, never operate under wet conditions. Any slight crack in the insulation of the power cord could give you a severe shock at 115 volts. Check the nameplate to see if it is double insulated or is properly grounded by a 3-prong plug. Never carry or drag the tool by its power cord.

Have your leader observe while you use the tool for the first time to be sure you are using safe and correct procedures.

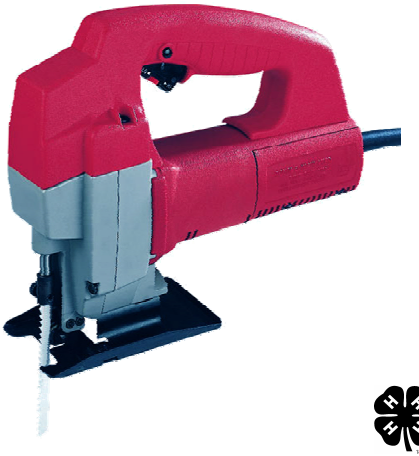
ANY OTHER TOOLS NOT COVERED IN THIS DISCUSSION SHOULD BE THOROUGHLY EXPLAINED BY YOUR LEADER BEFORE YOU USE THEM.

DRILL, ELECTRIC HAND- These 1/4" or 3/8" chuck drills are hand held and develop about 3/8 H.P. Sudden hang ups of the bit can create instant reaction of the handle and cause injury. If the switch is not immediately turned off and you lose the handle, the drill can twist up and break the electric cord. For this reason the switch should not be locked in the "run" position. Maintain a firm grip on the handle for full control.

Keep your fingers away from the turning chuck. Get in the habit of unplugging the drill when changing bits and removing the chuck key after tightening the bits.

SANDER, STRAIGHT LINE OR ORBITAL- The main thing to remember here is that this is an electric tool and you should always observe caution similar to that when using the electric drill.

SABER SAW- This saw is usually used for cutting curves. It usually develops 1/5 H.P. and the blade vibrates 2000 to 3000 times per minute. If the blade hangs up, the saw can jump out of your hands. A firm grip is necessary and steady pressure of the saw against the work piece is necessary for safe operation.



Use the proper blade (number of teeth per inch for the material being cut) and don't force the cut. Be sure to let the blade stop motion before removing it from a cutting position. Don't let the vibrating blade touch any part of your body. Don't be absent minded about this hazard.

JIG SAW (TABLE TYPE)- This tool is also for cutting curves. Even though it is mounted on a table make sure it is grounded and don't use it in wet conditions. See that it is mounted securely and the table won't turn over.

The most dangerous part of the tool is the blade. Be conscious about your hands getting too close to it while you are operating the saw. Keep your hands out of line of the cut.

Some models have blade guards but the guard cannot assume complete safety against carelessness. Do not attempt to make cuts on small pieces.

Some models are dual purpose, such as a light duty sander on the motor shaft. Make sure you don't accidentally touch the moving parts while sawing.

Safety Reminders:

1. Remove loose clothing. Roll up your sleeves.
2. Always wear safety glasses or some type of eye protection when using these power tools.
3. Disconnect the power cord whenever changing or adjusting blades or bits. Make all adjustments before starting the tool.
4. Keep blades and cutting edges sharp to reduce the possibility of overheating or kickback.
5. Before starting, check the location of the electrical cord so it will not be cut or damaged by the tool.
6. Have the tool or material in a ready position before starting and shut off power upon completion.
7. Don't force the power tool, let it feed at its own speed.
8. With hand held power tools, secure the work and never attempt to hold small pieces with your hand.
9. Always concentrate on your work. Avoid distractions such as talking to other persons.
10. When possible hold the tool with both hands for safe and sure control.

Safety Quiz for Light Duty Power Tools

Each 4-H member enrolled in the woodworking program should study the safety Guidelines on light duty power tools then take this quiz and have it graded by your leader before using any of the tools.

1. The straight-line sander is a very safe electric powered tool and needs no safety rules. (T or F) _____
2. The blade of the saber saw can hang up and jerk the tool out of your hand if it is carelessly held. (T or F) _____
3. The bit of the electric drill can hang up and twist the handle out of your grip if it is carelessly held. (T or F) _____
4. Portable electric tools should always be unplugged when changing bits or blades. (T or F) _____
5. The dangerous part of the saber saw is the blade. (T or F) _____
6. The blade of the saber saw is not automatically protected after cutting is finished. (T or F) _____
7. Because they are light duty these tools may be carried about by the power cord. (T or F) _____
8. The most dangerous part of the table jig saw is the blade. (T or F) _____
9. If this blade is guarded you don't need to worry about your hands getting too close to it. (T or F) _____
10. If the jigsaw is dual purpose, such as a sander wheel attached, special care must be exercised that you don't accidentally touch the sanding disc while sawing. (T or F) _____
11. It is possible to inflict serious injury to your leg by absentmindedly letting the saber saw blade touch your leg while it is vibrating. (T or F) _____

Safety Guidelines for Portable Heavy Duty Power Tools

Heavy duty electric tools that are hand held produce relatively high horse power and generally require both hands to control them properly. Never use these tools while off balance or in an awkward position. Since they are electric always check for proper grounding and never operate under wet conditions, since any slight crack in the insulation could result in a severe shock at 115 volts. Never carry or drag the tool by the power cord. All tools should be properly sharpened and adjusted so that less power is required and the tool will be less likely to slip. You should gain experience in proper use of light duty tools before using the more powerful heavy duty ones.

Have your leader observe while you use the tool for the first time to be sure you are using safe and correct procedures.

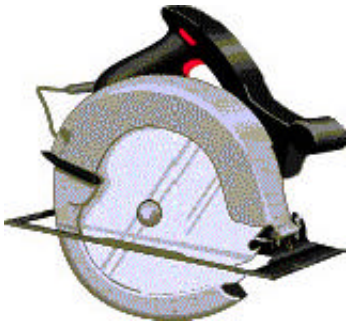
ANY OTHER TOOLS NOT COVERED IN THIS DISCUSSION SHOULD BE THOROUGHLY EXPLAINED BY YOUR LEADER BEFORE YOU USE THEM.

DRILL- The horsepower of these drills ranges from ½ to ¾. You will note that it has two handles and a squeeze switch. Always brace yourself so that you can hold against the strong twist of this tool. If it does get away the squeeze switch will automatically stop but some damage could result from the inertia built up. The safety precautions of the light duty drill also apply.

SANDER, DISC AND BELT- Some of these tools can develop up to 1 H.P. Hold it securely. Always unplug the power cord when changing abrasive paper. Make sure the power cord does not touch the belt or disc while in operation.

PLANER- A very handy tool for taking the hard work out of smoothing boards. Develops ¼ to 3/8 H.P. and turns at 25,000 rpm. Do not set the tool down until it stops. Be very cautious about the fast turning blade. Don't let it touch you. Hold the planer with both hands at all times and be sure the work is held securely in place.

CIRCULAR SAW-This tool can develop up to 2 H.P. It uses a squeeze trigger switch. Generally the higher H.P. saws have a second handle or knob for sure control. Don't force the blade as it can kick back. Use proper and sharp blades and saw only in forward directions. Do not attempt a turn in a cut. Be alert where the power cord is. Make sure the board sawed is held securely. Don't lay this tool down until the blade stops. Always unplug the power cord before attempting to change the blade. Don't put the blade on backwards. Make sure the blade guard is in place and is working properly.



RECIPROCATING SAW-These heavy duty hand tools develop 1/2 to 1 H.P. The more power the more sure your grip must be. Use the right blade for the job to limit hang ups. Never lay the tool down while it is still in motion. Remember this tool has no blade guard or protection devices. The higher H.P. saws should have a second handle or knob for additional control.

ROUTER-Heavy duty routers develop up to 1 H.P. and rotate at 25, 000 rpm. Because of this power and speed and because the bits cannot be automatically guarded, this tool can be very dangerous if not handled properly. It is a two hand tool. Use it that way. Don't set it down until it stops rotating. Unplug the power cord before changing bits. Be sure you are familiar with the entire instruction book.

Safety Quiz for Portable Heavy Duty Power Tools

After studying the section on safety Guidelines for these tools take this quiz and have it graded by your leader.

1. Carrying the electric drill around by the power cord can cause the insulation to break and become dangerous. (T or F) _____
2. Heavy duty drills don't kick back as bad as smaller drills if the bit hangs up. (T or F) _____
3. You must see that the work being drilled is firmly held as well as to have a firm hold on the drill. (T or F) _____
4. Hand held drills usually develop 2 H.P. (T or F) _____
5. Heavy duty sanders are so safe no special safety precautions need to be taken. (T or F) _____
6. The abrasive paper on a sander is so safe no special safety precautions need to be taken. (T or F) _____
7. Heavy duty sanders should have 2 handles for safe and proper control. (T or F) _____
8. The hand held power planner uses so little power that care of its power cord is not important. (T or F) _____
9. Even though the blade of the power planer turns very fast it is not considered dangerous because it protrudes so little from the bottom. (T or F) _____
10. Both hands should be used on the heavy duty saber saw to assure positive control. (T or F) _____
11. The more powerful heavy duty reciprocating saw has an automatic blade guard provided for your protection. (T or F) _____
12. The back side of a board being sawed is an extremely dangerous place because the saw teeth extend through unguarded. (T or F) _____
13. If a power tool has a squeeze switch it's O.K. to change blades without unplugging the power cord. (T or F) _____
14. The router can be safely controlled by one hand. (T or F) _____
15. Its extreme speed, relatively high H.P. and unguarded blade makes the router a potentially dangerous tool. (T or F) _____

Safety Guidelines for Heavy Duty Stationary or Bench Tools

These tools are usually relatively large and are not moved around. They may be permanently wired to the electric power and the only way to turn the power off is by the control switch on the tool or at the fuse box. You should find out about tools with many adjustments. Be sure to get special instructions from a qualified person and study the operators manual before using any of these tools. Have your leader observe while you use the tool to be sure you are following correct procedures.

All tools should be properly adjusted and sharpened so that they take less power and the work is less likely to slip.

Keep sawdust and shavings swept up often to help prevent slipping.

ANY OTHER TOOLS NOT COVERED IN THIS DISCUSSION SHOULD BE THOROUGHLY EXPLAINED BY YOUR LEADER BEFORE YOU USE THEM.

BAND SAW- The electric motor on these saws ranges from ¼ to ½ H.P. The blade speed is about 300' per minute. Always use eye protectors when operating this saw. Never let your fingers get closer than 2 inches of the running blade. Do not adjust the blade guides while the tool is in motion. Don't try to cut smaller circles than the blade is designed for. Always wait for the blade to stop before removing small pieces of cut material near the blade.

DRILL PRESS- This is a versatile machine. Study the operators' manual so you can make proper and full use of its capabilities. Large floor models have ¾ H.P. motors. Always use eye protectors. Make sure the work is clamped properly so the belt will slip rather than the work spin around if the bit hangs. Do not let any part of your clothing or hair come close to the turning bit as it can easily snag and twist up. Remove the chuck wrench after changing bits.

JOINTER- This tool has a 1/2 HP or larger motor. The blade rotates very fast at 5,000 to 6,000 rpm. If you are careless this tool can inflict severe injury especially to the hands. Always wear eye protectors. Keep the knives sharp and balanced. Keep the floor clean to prevent slipping.

Do not run material through without checking for nails or bad knots that could be knocked out. Keep the guard in place and working properly. Never try to run stock through that is less than 12" long. Use a special made push stick when you're near the end of a long board.

LATHE- Wood turning lathes normally utilize 1/3 to 1/2 HP motors. Be sure to study the instruction book and get special hints on this operation from a qualified person. Always wear eye protection and be sure the cutting tools are sharp and the tool rest is adjusted properly. Never touch the work piece with your hands while it is turning under power, no matter how smooth it looks. Make adjustments only while power is off.

RADIAL ARM SAW-These saws can have motors up to 6 H.P. The smaller shops might have saws of about 2 H.P. Be sure material to be sawed has no nails or other objects that could damage the blade or make it jump.

Never leave wood scraps or tools on the saw table and never leave the saw until it stops.

When ripping, be sure the blade turns toward you. Adjust the anti-kickback device properly. Always use a push stick when the saw blade nears the end of a board.

SANDERS, BELT AND DISC- Stationary shop sanders usually have 1/2 HP motors. Special care must be taken and not let bare skin touch the abrasive surface or severe burns can result. Eye protection should be worn because of the large amount of small particles ground off. Never leave the sander without turning it off. A dust mask is desirable unless the sander is especially equipped with a dust catcher.

TABLE SAW- The table saw, like the portable circular saw, can be a very dangerous tool. Some large saws have motors of 4 or 5 H.P. The common home shop saw is 1/2 to 2 H.P. with 8 to 12 inch diameter blades. Automatic protectors cover the blade and anti-kickback devices are available. See that they are in place and working properly. Never let your hands get close to the blade. Always wear eye protection. Do not use the miter gauge and fence at the same time.

Use a push stick when the saw blade nears the end of the board.

BENCH GRINDER- Several of the hand tools require frequent sharpening or dressing. This can be done with a steel file and vise or much faster and easier with a bench grinder. This can be a very dangerous tool. Special care must be taken to operate it properly. Get special instructions before operating it. The abrasion (grinding) wheels are manufactured by special sand embedded in bonding material. Accidental flaws can be present in new wheels. Stand to one side when starting up any grinder until it has reached full speed. Do not grind from the side unless the wheel is designed for that. Don't let the tool being ground wedge between the rest and the grinder wheel. This could break the wheel and it would then shatter or explode. Always wear eye protection to guard against the high-speed minute flying particles.

Safety Quiz for Heavy Duty Stationary or Bench Tools

After you have studied the section on Safety Guidelines for these tools take this quiz and have it graded by your leader.

1. After you have started the band saw you should adjust the upper blade guard to its correct distance above the work you are sawing. (T or F) _____
2. You use the same band saw blade for all circular cuts. (T or F) _____
3. The band saw blade runs slow enough that there is no danger to your eyes. (T or F) _____
4. Correct blade speed is about 300 ft. per minute. (T or F) _____
5. It's O.K. to hold all sizes of wood to be drilled by hand rather than clamping. (T or F). _____
6. When operating a bench type drill press you need not worry about the bit hitting any thing after it goes through the work piece. (T or F) _____
7. Drill bits are smooth enough so that there is no danger of clothing being snagged and twisted up while the tool is being used. (T or F) _____
8. It's O.K. to hold all sizes of wood to be drilled by hand rather than clamping. (T or F) _____
9. There is little reason for safety glasses being worn while operating a drill press. (T or F) _____
10. Your hands are especially vulnerable to severe injury while operating a jointer. (T or F) _____
11. A special push stick is a necessary part of the jointer. (T or F) _____
12. The blade of the jointer rotates the fastest of any of the power tools.(T - F) _____
13. The tremendous speed of the blade allows the jointer to easily and safely cut through nails and hard knots. (T or F) _____
14. The jointer is especially adapted to handling small working stock. (T or F) _____
15. The unique guard on the jointer does not allow the fingers to touch the blade. (T or F) _____
16. You may touch the work by hand while it turns in a lathe to determine if more sanding is needed for a smoother surface. (T or F) _____
17. After turning the lathe on you adjust the tool rest as near as possible to the work. (T or F) _____
18. Sawdust on the floor around the radial arm saw is not as dangerous as if it were around the table saw. (T or F) _____
19. A dust mask over the nose is desirable when working with a sander.(T - F) _____
20. Eye protection is not necessary if the dust mask is worn. (T or F) _____
21. The table saw is one of the most dangerous tools. (T or F) _____
22. Table saws have blade guards. (T or F) _____
23. With the blade guard in place safety goggles need not be worn. (T or F) _____
24. Because it is motor driven the bench grinder is a very safe tool. (T or F) _____
25. Grinder wheels can explode. (T or F) _____
26. Small particles are emitted while grinding and face protection should always be worn while using the bench grinder. (T or F) _____

Wood Joint Fasteners:

The joining or fastening of wood pieces together is an essential part of wood utilization and fabrication for sturdy and long life performance of the item or project. Nails are the simplest and most common type of wood fastener but generally create the weakest joint compared with the other fasteners described in this section. Good wood glue can produce the strongest joints in most situations. Wood screws and bolts are next strongest. Staples rank about equal with nails for strength but are often used with pneumatic (air) applications for rapid assembly and construction. Many nail sizes can also be applied with pneumatic equipment.

Nails:

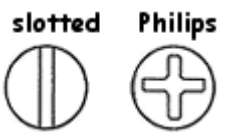
The most common types of nails for wood working projects are wire brads, finishing, and box nails. Wire brads are available in lengths of ½ to 1 inch and are used for thin materials of ¼ inch or less. Finishing nails have a small head that can be driven slightly below the surface of the wood . A wood filler or putty is often used to fill the depression and give a smooth surface for finishing. Box nails have a smaller diameter than 'common' nails to reduce splitting in wood joints. The 'spiral' or 'screw shank' nails have a threaded type shank that gives greater holding strength in joints. Some sizes and lengths of the smaller nails of these types are shown in the table.

Size	Length, inch	Approx. No./ Lb
2d	1.0	847
3d	1.25	542
4d	1.5	294
5d	1.75	254
6d	2.0	167
7d	2.25	150
8d	2.5	101

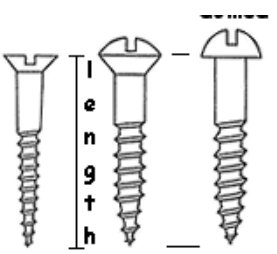
Wood Screws

Wood screws are classified by the type of drive, the shape of head, its length, gauge and whether it is designed for wood or metal.

Types of drive. The two basic drive designs are single slot and crosshead. Crossheads are normally either 'Philips' or 'Pozidrive', these require specific types of screwdriver although a Philips driver can be used on Pozidrive screws. It is always important to use the correct size of screw driver to ensure that the workpiece and screw are not damaged. Newer 'square' and 'Torx' drives are becoming more readily available for wood and metal screws.



Head shapes. The three main head shapes for wood screws are: flat, oval and round. Flat head screws can be countersunk so the heads can be concealed below the woods surface. Oval head screws give a more finished appearance for hinges and accessory attachments. Round head screws fit on top of a flat surface. Wood threads have a tapped screw while sheet-metal screws have mainly a parallel thread.



Length: The length of a wood screw is measured from the tip of the point to the surface of the material into which the screw is driven, which is the head's widest part. So the length of a flat head wood screw is measured from the tip to the top of the head, but the length of a round head screw is measured from the tip to the bottom of the head. In the common wood screws the thread extends 2/3rds of the length of the screw. Some other types (such as sheet metal and dry wall screws) are threaded all the way to the head.

Screw sizes. Screws are sized by gauge number and length. The gauge number was thought up by someone in a weird manner. If the gauge is not known, simply measure the diameter of the head in sixteenths of an inch, take away one and double - that is the gauge number. Example:

- if the head is a quarter of an inch, that equates to 4 sixteenths;
- take away 1 equals 3;
- double that equals 6, so it is a 6 gauge screw.

Stringing all these parameters together, one might buy, for example, a box of one hundred 2½ inch #12 flat head Phillips wood screws.

Bolts: The most common bolts are hex and carriage head types although very small bolts are often referred to as 'machine screws' and can have flat or round heads.

Hex Head Bolt: A hex head bolt has a head with six sides (hence, 'hex') and a smooth shoulder area beyond the standard amount of threading. Shorter lengths are fully threaded. Low cost bolts are made from low carbon steel and zinc plated. These are best for general hardware use where high strength is not required. Hot dipped galvanized bolts are much more corrosion resistant than zinc plated bolts. Steel bolts are available in 3 grades of hardness: grade 2, 5 and 8.

Carriage bolt: A bolt used in special wood and machine applications with a domed top and a square shoulder under the head. This shoulder pulls into the wood as the nut is tightened. Sometime carriage bolts are used in machinery where the square shoulder under the head fits into a square hole and prevents the head from turning as the bolt is tightened. The domed head provides a relatively smooth finished surface.
Other bolt types also can have a flat head and be countersunk for a completely smooth surface with the work piece.

Lag Bolt: Lag bolts are hex head bolts with wood screw threads. These are for heavy duty fastening of wood members. A flat washer should be used under the head if the head is tightened against a wood surface.

Glue: Glues and adhesives are very important in wood construction projects. These products can bind the wood pieces together with strength as strong as the wood itself and can be waterproof. 'Glue' products are usually made from naturally occurring materials (animal or vegetable) whereas 'adhesives' are made from synthetic materials (such as resins). Important steps in using wood glues for strong and durable joints include:

- Read the label on the glue for aplication methods and curing time.
- Make sure both surfaces are clean and dry. Wax, oil, and dirt prevent good bonds.
- If there is old paint, make sure it is solid. Flaking paint must be removed.
- It helps if the surface is porous or a little rough; it gives the glue something to "grip" on. You might want to scuff the surface with fine sand paper; or even sand it all over. Either way, wipe off the dust afterwards.
- Store unused glue in a cool, dry place. Any environment that *you* feel comfortable in is ideal for storage of glue.
- Keep unused glue, well-sealed. Usually, this just means put the top tightly back onto the container.
- Two-component glues, like epoxy, can not be stored once mixed. Use it, or it hardens into a lump.

Warning on 'Cyanoacrylate' products like 'crazy glue' or 'instant glue':

These products are quick bonding and very sticky to the materials and skin. Keep away from skin and eyes. Use the dispenser, sticks or tools to apply to the joints. Do not swallow or inhale. Keep out of reach of children. Clean off any residue on the hands and skin quickly with soap and water or hand cleaner. If it gets into eyes, rinse them with eyewash and consult a physician.

ANSWERS TO SAFETY QUESTIONS

GENERAL SAFETY

1. T
2. F
3. T
4. T
5. T
6. T
7. F
8. F
9. F
10. T

HAND TOOLS

1. T
2. T
3. F
4. T
5. T
6. T
7. T
8. F
9. F
10. F
11. T
12. F
13. T
14. T
15. T
16. F
17. F
18. T
19. F
20. T
21. F
22. T
23. F

LIGHT DUTY POWER

1. F
2. T
3. T
4. T
5. T
6. T
7. F
8. T
9. F
10. T
11. T

HEAVY DUTY POWER

1. T
2. F
3. T
4. F
5. F
6. T
7. T
8. F
9. F
10. T
11. F
12. T
13. F
14. F
15. T

HEAVY DUTY STATIONARY

1. F*
2. F
3. F
4. T
5. F
6. F**
7. F
8. F
9. F
10. T
11. T
12. F***
13. F
14. F
15. F
16. F
17. F*
18. F
19. T
20. F
21. T
22. T
23. F
24. F
25. T
26. T

*Make any adjustments only while the tool is stopped.
**The bit may hit the support table or vise.
***The speed of the hand held planner and router is greater.

LEVEL I

NUMBER	TITLE	NUMBER	TITLE
101	Note Holder	114	Knife Rack
102	Magazine Rack	115	Ice Cream Stick Frame
103	Picture Frames	116	Book Ends
104	Bed for Cat or Small Dog	117	Belt & Necktie Rack
105	Necktie or Towel Holder	118	Airplane & Stand
106	Nest for Robins and Phoebes	119	Log Cabin
107	Tin Can Flower Pot	120	Hurricane Lamp
108	Pet Lunch Counter	121	Trivet (Hot Pot Support)
109	Doorstop	122	Launch Pad Napkin Holder
110	Planter	123	Half Shelf
111	Sandpaper Block	124	Bunk House Serving Tray
112	Pencil Holder		
113	Small Flag Holder		

LEVEL II

NUMBER	TITLE	NUMBER	TITLE
WS201	Jewelry Box	WS210	Nine-Block Puzzle
WS202	Revolving Tie Rack	WS211	Cutting Board
WS203	Tool Tray	WS212	Nail and Tool Tray
WS204	Letter Box	WS213	Plant Forcing Box
WS205	Bluebird House	WS214	Tie Rack
WS206	Book Rack	WS215	Shop Tool Rack & Shelf
WS207	4-H Key Holder	WS216	Ladder Toy
WS208	Serving Dish Shelf		
WS209	Wren House		

As additional plans are made available, write the number and title on this sheet and insert the plan sheet in its proper level.

LEVEL III

NUMBER	TITLE	NUMBER	TITLE
WS301	Fold-up Porch Table	WS310	Book Shelves
WS302	Garden Bench	WS311	Portable Shelving
WS303	Tool Cabinet	WS312	Plywood Slot-Together Box
WS304	Planting Box	WS313	Laundry Hamper
WS305	A Flower Matrix	WS314	Hanging Colonial Wall Shelf
WS306	Combination Shelf & Towel Holder	WS315	Lumber Box and Trellis
WS307	Closet Door Shelves	WS316	Redwood Octagon Planter
WS308	Book Case		
WS309	Lawn Stools		

LEVEL IV

NUMBER	TITLE	NUMBER	TITLE
WS401	Porch Swing	WS419	Bench
WS402	Picnic Table with Bench	WS420	Shop Creeper
WS403	Narrow Bookcase	WS421	Sun Sled
WS404	Music Bench	WS422	Bunk Bed
WS405	End Table	WS423	Stereo Player Cabinet
WS406	Chest of Drawers	WS424	Alternate Board Fence
WS407	Chaise Lounge	WS425	Basket Weave Fence
WS408	Low Room Divider	WS426	X-Support Yard Gate
WS409	Night Table	WS427	Dowel Yard Gate
WS410	Folding Table – Tennis	WS428	Patio Bench
WS411	Tall Room Divider	WS429	Table-Desk
WS412	Desk that Grows	WS430	Gun Cabinet
WS413	Bench and Picnic Table	WS431	Lawn Chair
WS414	Gun Rack #1	WS432	Deck Chair
WS415	Gun Rack #2	WS433	Victorian Planter
WS416	Coffee Table #1	WS434	Telephone Bench
WS417	Coffee Table # 2	WS435	Planter with Gravel Tray
WS418	Sectional Patio Tables		

As additional plans are made available, write the number and title on this sheet and insert the plan sheet in its proper level.