

# **WOODWORKING**

## **Level I and II**

### **Leaders' Guide**

*Ontario 4-H Council*

*Ontario Ministry of Agriculture, Food  
and Rural Affairs*

4-H 2490 94 LE

*The primary purpose of the 4-H program is the personal development of youth in rural Ontario.*

## THE 4-H PLEDGE

"I pledge:  
My Head to clearer thinking  
My Heart to greater loyalty  
My Hands to larger service  
My Health to better living  
For my club, my community and my country."

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## **BE A "GREEN" 4-H CLUB**

The 4-H program uses a lot of paper. Please help us to reduce our costs, and save a few trees, by remembering these tips.

- Only 4-H members (10-21) and screened volunteers should receive 4-H resources.
- If your club plans to do this project again, keep the resource materials so you don't need to reorder.
- If your club has extra resources, please return them promptly to the Ontario Ministry of Agriculture, Food and Rural Affairs office so they can be used by someone else.

## **WELCOME TO 4-H**

It has often been said that, "Volunteer 4-H leaders are a blend of friend, teacher and parent." What a big order to fill! But you will discover that you have many talents as a 4-H leader. Having an interest in young people and their development and being willing to take up the challenge of 4-H leadership is the first step to success.

This project focuses on woodworking. However, the development of members as individuals is your real goal. You will get to know the club members and where their interests lie very well. Use this knowledge, your own expertise and imagination to plan a fun, interesting and challenging club program for your members. And enjoy being a 4-H leader!

## **WHAT ARE MY RESPONSIBILITIES AS A 4-H LEADER?**

### **Before your project begins:**

1. Familiarize yourself with current provincial and local 4-H policies;
2. Attend a leader training session (if scheduled);
3. Advertise the project and organize a club with a minimum of six members; and
4. Review available resources and begin planning the club program.

### **During the project:**

1. Attend each meeting and the Achievement Program;
2. Assist members in planning and presenting the club program;
3. Provide a FUN, learning atmosphere;
4. Ensure the club membership list is completed and forwarded to the Ontario Ministry of Agriculture, Food and Rural Affairs office before the second meeting;
5. Help each member to set and achieve goals for personal development;
6. Encourage members to work together as a group;
7. Provide guidance in choosing and completing an Achievement Program; and
8. Evaluate the club program.

## **4-H CLUB PROGRAM PLANNING**

A successful 4-H club doesn't just happen! Careful planning is necessary and very important. As a 4-H leader, you have a responsibility to do the best job you can in providing a fun, learning experience for the 4-H members. Planning will make this a reality.

The 4-H Volunteers' Handbook has lots of valuable information to help you and your members plan a successful club program. Refer to "The 4-H Meeting" section of your handbook for tips on planning successful meetings, effective communication, games, judging and special events. The chart on page 3, of this Guide, can be used to record your plans.

### **WHAT IS AN ACHIEVEMENT PROGRAM?**

- An opportunity for members to share with others the knowledge and skills they have gained during this 4-H project.
- Involves each member in some way.
- Informs the public about the purpose and goals of the 4-H program.

Achievement Program ideas specific to this project are suggested below. Many of them require preparation and construction, so selection should be made early in the project. Involve club members in selecting a suitable idea and making the necessary preparations. Be sure to make the media aware of your program.

1. Have members build bluebird boxes. Work with a local program/group already in existence (or on your own if necessary), to set these boxes out and perhaps help in a banding program.
2. Recognizing the need to replenish the resources we use, plant some trees. This could be done in conjunction with a conservation area or a local school. Contact the district Ministry of Natural Resources office for an application to apply for a Canadian Wildlife Improvement Program (CWIP) grant. You may want to work with several different species and add an identification aspect to the project.
3. Have members make bed trays, and work cooperatively with a local "Meals-on-Wheels" program, or seniors' centre, to distribute them.
4. Each member can make two or three saleable items, and participate in a local arts and crafts sale. Proceeds can be donated to programs aimed at replanting or preserving forests around the world (e.g. Temagami Wilderness, World Wildlife Fund for their "Guardian of the Rainforest" program, Plant-a-Tree-in-Africa).
5. Members can make stilts and sponsor an open contest. Hold the contest at an annual community program "Summerfest," Canada Day activities, fairs, etc.

# 4-H CLUB PROGRAM PLANNING CHART

MEETING OR EVENT	DATE	TOPIC ACTIVITY OR TASK	PEOPLE WHO COULD HELP	PRESENTATION IDEAS TO CONSIDER

6. Become "Resource Preservers" by acting as a recycling coordinator of "scrap" wood. Contact all local manufacturers of wooden products (doors, furniture, handles, etc.), and take inventory on all useful scraps, particularly standard cutoff or waste. Make this inventory list available to amateur woodworkers and craftspeople who might be able to put these resources to good use.
7. Contact a toy-lending library or day-care centre and see what they need. You could make and donate two or three toys, or they might prefer a sand box or toy chest. (Remember, because young children will use these toys, there are special concerns and restrictions about their construction and finish.)

## **SPECIAL NOTES FOR THIS PROJECT**

### **RATIONALE**

Young children have a natural urge to build. By doing so they learn how things work, and how they can alter the world around them. Ironically, as our technology becomes increasingly sophisticated, it generally robs children of the opportunity to try the simplest of skills. It is no longer common for kids to have access to basic tools like hammers and saws, or the material to work with. Even the simple models a child might use as a reference are rapidly disappearing too – such as a pulley, block and tackle, lever or spring.

If children are to have any understanding of complex technologies, they must begin with an understanding of simple ones. By offering this Woodworking Project you are giving them a chance to gain some of that basic understanding.

### **OBJECTIVES**

This project is a very basic introduction to several aspects of working with wood. It was necessary to take this starting point, given the premise that members have little experience, and likely few tools and materials at hand.

### **LEADER TRAINING**

While it is not necessary for leader(s) to be full-fledged carpenters or cabinetmakers, some basic understanding of woodworking skills is essential. Perhaps the best way of gauging whether you are qualified to handle this project alone is to scan the resources and see if the topics and procedures look familiar and straightforward. If there are only a few topics you are not experienced in, consider going to a local woodworker and getting a little training on those. If you feel overwhelmed by most of the meeting topics, see if a local woodworker would like to help lead the project with you, or give you more extensive training. (In most cases, both amateur and professional craftspeople are quite thrilled to be asked to share their knowledge.)

## WORKING WITH THE CLUB'S MIX OF MEMBERS

Each club will have a different mix of members, with regards to ages, skills and interests. How each leader handles this situation will be very individual. The total number of members in the club, and whether the club will have a mix of skill levels is up to the leader(s). Some 4-H leaders who have run locally approved woodworking projects found that having members with a close skill level seems to work best. In some cases, you may find it necessary to run one level at a time.

If the club has a mix of skill levels, the advanced members will prove invaluable in helping the novice members. Having the different skill levels cooperate on a job (e.g. the advanced members using a router and the novice sanding), can work very well. Many of the activities will be good "refreshers" for the more skilled members. Hopefully these experienced members understand that honing their skills and increasing their knowledge of wood only comes with practice.

These experienced members want to learn something as well. Choosing an interesting project will make a big difference. Getting frequent input from the leader(s) also keeps them interested. If there is more than one leader, or you have some assistance, you can separate the experienced members from the rest of the group at certain times, and cover some of the advanced information. Talk to these members. They may have very clear ideas of what they would like to do.

## SAFETY

The project's use of tools bring with it some concerns about safety. Although there is minimal risk because of tools chosen, these must still be recognized. It is recommended that you make copies of the note on page 64 and ask **every member to have the note signed by a parent or guardian. Every member should have goggles.** These are inexpensive insurance for irreplaceable eyes. Check with a local hardware store, perhaps buying as a group could mean significant savings.

It is essential that the basics of safety be stressed with all members, first and foremost. The development of safe working habits will be one of the most valuable outcomes of this entire project. It will be the leader's responsibility to ensure that safety is not jeopardized by "horsing around" or "showing off."

## HELP

Encourage members to ask for help, even when they are working at home. Emphasize that **doing it themselves does not mean doing it alone.** Extra hands holding pieces, or someone explaining or showing how to do something are all part of the learning process. Helpers only need some patience, common sense and a few basic woodworking skills to help out. Discuss with each member the possible options he/she has for a home helper. Take mom and dad, guardians, brothers and sisters, grandparents, neighbours and local woodworkers into consideration.

Even within meetings, have members choose a "buddy" to work with. Not only can they help and teach each other, but hopefully they will also realize that cooperation can result in more being accomplished. Buddy-teams could remain the same for the entire project, or they could change from meeting to meeting. Pairing an experienced member with a novice member may work best.

## THE PROJECTS

There have been several project suggestions made for both levels of members. Hopefully the range of options will suit most members' interests and tastes. **Be flexible with members.** If they would like to modify a design somewhat, that's great, but make sure **all** the necessary changes have been made. Or if they have totally different ideas that suit their skills and interests, work with them. You might suggest they review some library books for ideas, perhaps starting with the books listed in the bibliography on page 8, this Guide. (Those containing plans for some of these project suggestions are in bold.)

All the projects suggested for Level I, and most of those for Level II are ones in which function is more important than form. With early woodworking efforts, a beautiful product is not easy to achieve. Function acts as an immediate test of success, and one that delights its young creators.

Keep in mind that **the projects suggested are just that, suggestions.** They are intended to present options and ideas, not crush members' creativity. With most of them, certain variables can be selected to increase the difficulty and challenge of the project. Some general variables are: cutting a more difficult outline, using hardwood instead of softwood, using complex joints instead of a simple butt joint, or deciding to do a top quality finish.

Large projects have not been suggested. This is for several reasons. Large projects take more material, and generally use more expensive kinds of material. For many members this would put such projects out of bounds. Large projects generally do not provide the **immediate** satisfaction that small ones do. Many novice woodworkers need quick rewards to maintain their interest. Lastly, if a member is really keen on doing a large project, he/she generally has something particular in mind and prefers to follow through with that idea.

## TOOLS

To allow as many 4-H members as possible to take part in this project, the requirements for tools are minimal. Even some of these may be a problem for your members. Talk to them and see if you can offer any suggestions, (i.e. borrowing tools).

Most of the project suggestions would require the basics: Hammer, crosscut saw, coping saw, tape measure, square, C-clamps, electric drill and bits. Some of the more involved projects or options would require pipe clamps and perhaps a skill saw.



When electrical tools are used, pay special attention to safety aspects. Doublecheck the condition of cords and plugs. Ensure that bits or blades are properly secured.

## WORKBENCH

Members need a place to work. Often a small area for a workbench is just fine. Talk to each member and see what possibilities he/she has at home. A home helper may have some ideas or options. Some members may be only able to work at meetings. Organize your meetings to take this into account, and try to maximize the time available for hands-on activity. You might also consider having more than six meetings.

## MATERIALS

Generally the cheaper grades of wood are fine. Emphasize to members that they consider recycling options. A neighbour who is remodelling or is a woodworker, or a store which has wooden crates could supply their needs.

Perhaps as leader you would like to contact a few carpenters or cabinet makers and look into obtaining scraps. This may also be a good way of getting to know someone who could be a great resource for this project. Some 4-H leaders who have done locally approved woodworking projects have had great success finding **sponsors who provided all the materials and hardware used (e.g. retail lumber stores)**. You might consider visiting a lumberyard in Meeting One, both to see the variety of materials available, and to obtain what is required for members' projects.

## **ADDITIONAL NOTES ON THIS PROJECT**

1. Page numbers refer to the Members' Manuals, Level I and II, unless otherwise indicated.
2. The Members' Manuals have been designed as reference sources. Hopefully, the members can leave their manuals closed for most of the meeting, allowing them to observe, learn and take part in the discussion and activities. It is not necessary – and usually not possible – to cover all the information given in the Members' Manual during the meeting.
3. **REMEMBER TO REFER TO YOUR 4-H VOLUNTEERS' HANDBOOK** - You will find many useful tips and ideas covering topics such as program planning, successful meetings, parliamentary procedure, effective communication and presentation methods. Refer to your Volunteers' Handbook as you plan meetings. If you do not have a handbook, one can be ordered through the OMAFRA office.

4. JUDGING - Judging is an optional activity in meeting three of this project. Each member should have a 4-H Judging Handbook (4-H-1550-91) and be encouraged to use it. These can be obtained from your OMAFRA contact.
5. You may find the OMAFRA Factsheet, Procedures for Meetings, 89-095, helpful.

## RESOURCES

### ADDRESSES

"Guardian of the Rainforest"  
c/o World Wildlife Fund Canada,  
90 Eglinton Ave. E., Suite 504  
Toronto, Ontario M4P 9Z9

Plant a Tree in Africa,  
Suite 202, 111 Queen Street East,  
Toronto, Ontario M5G 1S2

Ontario Bluebird Society,  
c/o Mr. William Read,  
2-165 Green Valley Dr.,  
Kitchener, Ontario N2O 1K3

### WOODWORKING MAGAZINES

The Family Handyman,  
Subscriber Service Dept.,  
52 Woodhaven Road,  
Marion, Ohio 43305

Woodsmith,  
P.O. Box 2241,  
Des Moines, Iowa 50310

Canadian Workshop,  
3781 Victoria Park Avenue, Unit 6,  
Scarborough, Ontario M1W 3K5

Fine Woodworking,  
Taunton Press,  
52 Churchill Road,  
Box 355A,  
Newtown, Connecticut 06470

## ANNOTATED BIBLIOGRAPHY

Please Note: The first two books just happen to be some of the best for this level of woodworking. The second book in particular is excellent for its visual and humorous approach to the subject.

Adkins, J., **Toolchest**, (New York: Walker and Company, 1973).

Beautifully hand-illustrated by the author, this book lovingly and humorously describes every hand tool used in woodworking and its appropriate uses. Includes plans for a **benchhook**.

Brown, W., **Wood Works: Experiments with Common Wood and Tools**, (New York: Atheneum, 1984).

"We turned to projects a child can explore with all the senses. We drew from the history of invention projects that are the building blocks of modern technology." The mousetrap tractor with the two-speed transmission, the **thaumatrope**, and the steam or paddle-wheel boats are great interest-catchers. Also includes **musical instruments** and a **pinball** challenge. Find this one first.

Constantine, A., Know Your Woods, (New York: Charles Scribner's Sons, 1975).  
Covers every imaginable wood in the world and its uses. A comprehensive reference with photographs.

Crump, D., The Complete Guide To Wood Finishes, (Toronto: Simon & Schuster, 1992).

This is an excellent book which covers every type of finish in a very clear fashion. Sidebars on most pages highlight the essential points for a quick reference. A great resource for any instructor.

Dalby, S., Make Your Own Musical Instruments, (London: B. T. Batsford, 1978).

Details thirty-eight **musical instruments** that can be made and played by children.

Engler, N., Country Accents (Emmaus, Penn: Rodale Press, 1989).

Includes interesting techniques like drill press turning, and how to draw an oval. The door harp project is a good one for Level II. Also includes **hex** and **animal signs**.

Hooke, R., Blowing in the Wind: How to Make Your Own Wind-Powered Folk Art Figures, (Camden: Down East Books, 1987).

Whimsical whirligigs from cyclists to sawyers show how different motions can be created using wind power. Has many good patterns. This book will help teach the history of wind technology.

Hylton, W., Build Your Harvest Kitchen, (Emmaus, Penn.: Rodale Press, 1980).

Includes some small kitchen projects for Level II. (**Bedtrays**)

Jackson, A., Day D., & Jennings S., Collins Complete Woodworker's Manual, (London: William Collins Sons & Co. Ltd., 1989).

An extremely comprehensive reference book, excellently designed. Has everything you need to know about wood and woodworking. There is a terrific chapter on designing in wood that stresses the human form.

Jacobson, J., Gift Projects from Wood, (New York: Sterling Publishing, 1992).

Includes projects in the country tradition that stress simple shapes and creative painting – **folk art animals** and **serving trays**. Many of these would be suitable for the Level I.

Joseph, J., Folk Toys Around the World, (New York: Parent's Magazine Press, 1972).

Learn to make eighteen toys from around the world. Check out "the thunderbolt" as a Level I project.

Kesselman, J., & Peterson, F., I Can Use Tools, (New York: Elsevier/Nelson Publishing, 1981).

A book written specifically for young readers detailing the creation of a birdhouse. One of the few that approaches the use of tools, techniques and fasteners, completely from the child's perspective.

Peppe, R., Rodney Peppe's Moving Toys, (New York: Sterling Publishing, 1980).  
Captures the imagination with colourful and innovative toys for the Level II learner. Good patterns and instructions.

Rockwell International, Projects for Outdoor Living, (Pittsburg: Rockwell International, 1978).

Some good outdoor projects that could involve a team effort and perhaps benefit the community. Level II.

Russo, M., & Dewire, R., The Complete Book of Birdhouses and Feeders, (New

York: Sterling Publishing, 1976).

This is primarily a book about birds with some simple houses and feeders that a child could build – including a **bluebird house** and **log suet feeder**.

Seitz, J., Woodcarving: a designer's notebook, (New York: Sterling Publishing, 1989).

This book will enlighten the reader to the potential of artistic woodcarving – a real eye opener.

Skeen, P., Garner, A., & Cartwright, S., Woodworking for Young Children, (Washington: NAEYC, 1984).

This book is written in a teaching style with the intention of initiating instructors. It outlines the goals and techniques of woodworking with an excellent annotated bibliography and good tool illustrations.

Starr, R., Woodworking with Your Kids, (Newtown, Conn.: The Taunton Press, 1990).

This book is written by an elementary school teacher showing children succeeding at tried-and-true techniques that guarantee a positive experience. Real tools like chisels and planes are used to make stools, games – **pinball**, signs, **toys**, boxes, and furniture at all levels of ability. It is well illustrated, with good advice on tools, techniques and safety. It includes a good bibliography.

Waring, D., Making Folk Instruments in Wood, (New York: Sterling Publishing, 1979).

This is a book about making instruments with kids and includes a lot of ideas and specifications.

Woodworker's Journal Editors, Projects for Woodworkers, Vol. 3, (New Milford: Madrigal Publishing, 1987).

The good clear layout of this "adult" book would make it a resource for Level II members. Some of the toy designs may be of particular interest also the **bootjack** and **plate stand**.

The 4-H Resource Development Committee of the Ontario 4-H Council reviews and evaluates 4-H resources. Comments and suggestions about 4-H manuals and guides are always welcome. They may be sent to the following address.

4-H Resource Development Committee  
c/o Guelph Agriculture Centre  
P.O. Box 1030  
Guelph, Ontario  
N1H 6N1

At the bottom of the table of contents page in the Members' Manual you will see the Kids Help Phone logo and number. Kids Help Phone is available to over 7 million children and teenagers throughout Canada.

It is a national, bilingual, confidential, toll free helpline staffed by paid, trained professionals. In response to the problems and concerns of our youth, Kids Help Phone provides a listening ear, emotional support, counselling, information and referrals. Children and teens from anywhere in Canada can call anonymously 24 hours a day, 365 days a year.

Children and teens can call about anything that is bothering them including – abuse; drugs; alcohol; conflicts with parents, friends or teachers; pregnancy; sexuality; suicide; or parental separation and divorce.

Please mention this number to your members and explain what it is for. Make sure they know that it is free and they don't have to give a name or address.



*The Kids Help Phone gets 1000 calls a day...  
2000 more get a busy signal. If you or your  
club or someone you know would like to  
make a donation to the Kids Help Phone,  
call 1-800-268-3062.*

## MEETING ONE

## ESSENTIAL RESOURCES

### OBJECTIVES FOR THIS MEETING

1. To ensure members are familiar with the proper safety precautions, particularly the use of goggles.
2. To explain the basic ways of describing lumber: shape, size, length, grade and species.
3. To discuss project and achievement program ideas, and help members decide what they would like to do.
4. To organize a buddy system for meetings, and a helper for home.

### GETTING READY

<b>ACTIVITY</b>	<b>PREPARATION AND EQUIPMENT</b>
Safety	For display, have goggles or glasses (different styles if possible), cap, shop coat, hammer with solid head, electric drill with 3-prong plug, drill bits and case. Eye patch, clothes pin and clothes line are optional.
Help	Hammer and nails (4 cm., 1 1/2"). And two pieces of scrap lumber 1 x 4 x 10" (approx. 2.5 x 10 x 25 cm) for each member.
Workbench	Samples of possible workbenches: large log, two large wooden boxes with boards nailed between the two, sturdy chair bottom, sandbags (or bags of softener salt) to use for extra stability.
Project Ideas	Have a variety of plans available that you think might be of interest to members.

### **LEVEL II**

Describing Lumber	Gather samples of wood to illustrate shape: round, square, rectangular and various mouldings. Size samples: 2 x 4", 2 x 6", 1 x 8" (50 x 100, 50 x 150, 25 x 200 mm respectively), hardwood and softwood samples plus plywood, particleboard etc. Contact carpenter or cabinet workers.
Making Lumber	Have large log, squared log, and marker to illustrate making lumber. Samples of wood to look at end grain.

Leaders may want to consider going to a lumberyard, to look at different materials, and to pick up material for the projects. Leaders may also want to visit a sawmill, or have a portable bandsaw mill brought in for a demonstration.

### TIME GUIDELINES

A time guideline has been provided for each section of the meeting. Please remember that this is only a guideline. The number of members, their maturity, specific interests and the availability of tools and work stations will all affect the duration of specific activities. **You do not have to do all the activities given for each meeting.** Choose those that best suit the interests and ages of your members.

<b>IN A NUTSHELL</b>	
Getting Started	15 min.
Roll Call	10 min.
A Road Map to Good Meetings	20 min.
Essentials - Safety	15 min.
- Help	15 min.
- Workbench	5 min.
Clean Up	10 min.
Before The Next Meeting	20 min.
	110 min.
Optional: Level II	

### GETTING STARTED (15 minutes)

1. Begin with the 4-H PLEDGE. Post a copy so everyone can see it.
2. WELCOME the members. Introduce leaders. Have members introduce themselves. Introduce the youth leader (if this has been decided). Ensure that everyone has a name tag.
3. Complete ENROLLMENT CARDS and/or MEMBERSHIP LIST.
4. Give a brief INTRODUCTION to the project.
5. Outline the OPPORTUNITIES members have such as taking part in the local fairs and shows, "4-H Go For the Gold," 4-H Members' Conference, etc.
6. DISTRIBUTE "4-H Club Member Lives Here" signs if available.
7. DISTRIBUTE the Members' Manuals.
8. Discuss the members' REQUIREMENTS for the project. See pages 1 and 2. Outline any expectations you have of the members.
9. Briefly discuss the ACHIEVEMENT PROGRAM - type, date, time, location.

The remaining time is used for activities related to the meeting material. Try to keep the members interested and involved by using a variety of techniques and activity coordinators – leaders, youth leader, guest or senior members.

**ROLL CALL** (10 minutes) page 5

Members are asked to identify themselves and explain their particular interests.

You might want to ask the following.

1. Are there specific skills they want to learn?
2. Are they interested in hobbies such as music, action toys, wildlife, etc. (to help identify possible projects)?
3. Have they done woodworking before, and if so, how much do they know?
4. Do they have woodworking tools and a place to work at home?

**A ROAD MAP TO GOOD MEETINGS** (20 minutes)

It is important for everyone to become familiar with the basics of running a good meeting. Review with members the purpose of an agenda and the executive's responsibilities. Have the club members elect an executive. You may find the 4-H Volunteers' Handbook and the OMAFRA Factsheet, Procedures for Meetings (89-095) helpful.

**ESSENTIALS** (Total: 35 minutes) page 5

**SAFETY** (5 minutes) page 5

It is important to stress that all work must proceed in a safe manner. Tools must be handled safely. No horse play is allowed. Even when just watching, members should have their glasses or goggles on.

**"BETTER LATE THAN NEVER - NOT!!!" EXERCISE**

Try this. Have all members who have shoe laces try tying them up **without** using their thumbs. Or perhaps have members try to do up buttons without their thumbs. How much fun would it be to do it this way all the time?

**"GETTING A PERSPECTIVE ON THINGS" EXERCISE**

Have each member take a turn at wearing an eye patch over his/her best eye. If you can string a line, have the member try to put a clothes pin on the line while the patch is in place. (This seems most difficult if there is nothing else on the line.)



## OTHER POINTS TO HIGHLIGHT

- Show different styles of glasses and goggles, and how to wear them properly. Emphasize they should be on whenever the member or anyone else is working.
- Show how tools must be safe to use, and properly handled.
- Show electric drill with good cord, and three-prong plug.
- Show hammer with head properly fastened.
- Show sharp tools like drill bits carried in their proper case, not in a back pocket.
- Show how to dress properly for work, or have half the members prepare themselves, and have the other half double check that they are ready.

## HELP (5 minutes) page 6

Discuss meeting buddies and home helpers.

- Members can buddy up with the same person for each meeting or work with someone different each time. You may want to try to have one experienced partner in each pair.
- If members will be working on projects at home, a homehelper would be beneficial. Suggest mom and dad, guardian, friends, brother and sister, grandparents, or a neighbour.

## "TWO PAIRS OF HANDS ARE BETTER THAN ONE" EXERCISE

Try the following exercise to convey the idea that working together will accomplish much more than working separately.

Each member needs two boards he can nail together to make a right angle joint (side to end grain), three nails, and a hammer. Have half of the buddy teams work together, doing one pair of boards at a time. Have the other half nail the pair of boards by themselves. See which teams drive the three nails and successfully make two butt joints first. (You may have to run this exercise in two or three rounds because of tool limitations, but try to have some of both approaches going at once).

Emphasize that the buddy or helper is there to provide support and an extra pair of hands – not to do all the work.

WORKBENCH (5 minutes) page 6

**WORKPLACE:** Have a discussion about what options each member has for working between meetings. Do not forget that for those members who can work with a neighbour or grandparent etc., their home helpers may have some ideas about where they can work. You might suggest: basement, utility room, garage or workshop.

**WORKBENCH:** It is important to emphasize that having a perfect workbench is not necessary. Even a sturdy chair bottom can work if it is made more stable. Suggest weighing down a chair or table with a sand bag, a bag of softener salt, or a cement block. Demonstrate how low benches are good for sawing, and are fine for other jobs (hammering, etc.) if you kneel. Show some ideas for simple workbenches if you are able to. These include:

- top of a heavy table;
- a large log, about 2' (60-70 cm) tall and 18" (30 cm) wide, possibly with a square of plywood (slightly larger than the log's diameter) nailed on top;
- two large crates, about 30" (80 cm) square, with boards, 2 x 6" (50 x 150 cm) nailed between them to form a top.

Discuss each member's own ideas about his/her "workbench."

CLEAN UP (10 minutes)

BEFORE THE NEXT MEETING (20 minutes total) page 7

ACHIEVEMENT PROGRAM AND PROJECT IDEAS (10 minutes)

Discuss the different ideas that have been suggested and help the members decide what they would like to do. Display any plans that are available. Consider the members other interests (music, wildlife etc.).

**ACHIEVEMENT PROGRAM**

To guide members in their decision making, have them consider the following.

- Do they want to produce a wooden article as the end result of their efforts? If so, consider # 1, 3, 4, 5 and 7. With many of these options each member would make the same article. Is this what they want?
- Do they want their efforts to make some positive impact on the resource side of woodworking? If so consider # 2, 4 and 6. (Notice that #4 fills both objectives.)
- Do they have other good ideas to offer?

## PROJECT SELECTION

Some of the Achievement Program ideas include members producing a wooden article. This may be enough for some members to work on. If members still want to select another project to make, have them consider:

- The time, facilities, and equipment they have for it
- Their skill level
- Their outside interests which may help focus on a project.

Hopefully, most members can begin their projects at the next meeting.

## MEMBER'S INFORMATION CHART

As you discuss members' options and interests, fill in the chart on the next page to keep track of past experience, buddy, home helper, work place, projects, etc.

## REMIND MEMBERS

- For the Roll Call of the next meeting they are to keep a "Wood Diary" for a day, recording all the wooden objects they use or see in a given day.
- Check out what tools and material are required for the next meeting and have them bring them, if they can. (The more tools available, the more work that can get done in each meeting).

## QUICK QUIZ (Optional)

Question: There is one "essential" requirement that is part of **every** woodworking task. What is it?

Answer: Concern for safety for yourself and others.



## **LEVEL II**

### **ESSENTIALS** (10 minutes) page 5

### **WORKBENCH**

Some senior members may be interested in, and capable of (with some help and guidance), building a "workbench" for themselves. Talk over some ideas with them. They might consider making the milk crate work bench (see Wood Works, by W. Brown) or saw horses.

### **FACTS AND FIGURES** page 5

### **WAYS TO DESCRIBE WOOD** (10 minutes) page 5

Wood is described in a few basic ways. To help members figure out as much as they can for themselves, divide the club into four groups. Each group is given some samples, i.e. a selection that illustrates **one** of the following categories: shapes, sizes, grades and species. Give each group a few minutes to sort their respective piles into a recognizable order and prepare to tell the rest of the club what they can about their samples. Here are some examples.

- Shapes: Sort into different types, e.g. round, rectangular etc., and then size them. Are they all the same type of wood?
- Sizes: Sort into graduated sizes and name them, if they can. (Remind them that most lumber is sold by imperial measure.)
- Grade: Try to figure out which grade is the best, which is the worst, and where those in between fit. Give them hints about what features are important here – finish, and defects like knots (number, size and whether they are loose).
- Species: From a wide range of samples see if members can put the same, or similar ones together. Have them explain how they arrived at their decisions.

As each group tells what they know, fill in with additional points, or correct if necessary.

MAKING LUMBER (15 minutes) page 7

Briefly follow through the process of cutting a log into lumber. If you are able, have a large log to illustrate the process. With a marker, mark a squared balk on the end grain, or better still, have a squared log. With the marker again illustrate how the log would be cut through-and-through (one end), and how it would be quarter and tangentially cut (opposite end) (See illustration page 7.)

Discuss the amount of waste, and guess the percentage that might be lost. Look through some of the wood samples you brought in, and see if members can tell how the lumber was cut.

## MEETING TWO

## READY, SET, GO...

### OBJECTIVES FOR THIS MEETING

1. To ensure that members recognize the importance of understanding the plans and organizing the necessary tools, materials and help, in advance.
2. To familiarize members with basic tools and materials.
3. To explain and show the differences between softwoods and hardwoods.
4. To demonstrate how to copy a pattern onto wood using carbon paper.

### GETTING READY

<b>ACTIVITY</b>	<b>PREPARATION AND EQUIPMENT</b>
Prior Planning	Fill in member's information chart.
Basic Toolchest	Have for display: tape measure, ruler (imperial & metric), squares (e.g. carpentry, try, framing and combination), hammer, saws (e.g. crosscut, back, coping), clamps (C-, pipe, web), sanding block, mitre box, jack knife, electric drill and drill bits.
Basic Materials	Have for display: pencil, masking tape, carbon paper, push pins, thumb tacks, graph paper, nails (various kinds and sizes), carpenter's glue, screws (various kinds and sizes), sandpaper (various grits and types – flint, garnet, etc.), clean cloths, oil and varnish finishes, permanent markers.
Transferring a Pattern	Have: pencils (somewhat dull), several sheets of carbon paper, push pins or thumb tacks, photocopies of enough patterns to copy and wood to use (or cardboard for practice).
Drawing & Dimensions	Photocopy enough of any one plan to have a copy for each buddy team.
Metric & Imperial	Have numerous cut offs of 2 x 4" (50 x 100mm) for members to measure. Photocopy enough "Handy" Measures Charts for each buddy team (optional).
Sample Measurement	Photocopy enough Wood Sample Measurement Charts for buddy-teams, and have several sets of four or five different sizes of wood samples to measure - prepare identical sets if you can (optional).

For Good Measure            Have several tape measures, a few rulers, several pieces of wood, some approx. 12" (30cm) long, as well as several pieces, approx. 6½' (2m) long – to compare accuracy between groups, have the groups use pieces that are the same length.

**LEVEL II**

Softwoods & Hardwoods            Have several samples of both softwoods and hardwoods, knife (jack or utility) and magnifying glass.

Orthographic Drawing            Bring a fairly simple article, perhaps a box with a lid, for members to discuss how it would be shown in this kind of drawing (optional).

Using Grid System            Have pencils, rulers, plain or graph paper, photocopies of a pattern to scale up in size, and scrap pieces of wood (optional).

<b>IN A NUTSHELL</b>	
Roll Call	10 min.
Minutes & Business	10 min.
Getting Organized	10 min.
Transferring a Pattern	15 min.
Marking & Measuring	25 min.
Project Work	35 min.
Clean Up	10 min.
Before the Next Meeting	5 min.
	<hr/>
	120 min.
Optional:	Level II

**ROLL CALL** (10 minutes) page 8

If members have not prepared a wood diary, have them look around the room they are in and list things made of wood. As members are reporting, have a senior record the items by category – furniture, utensils and tools, or decorations, etc.

- Was there far more in one category than another?
- Are there some categories or items wood is never used for? Is this because they are totally unsuitable (stoves), or are other materials a better choice (metal for airplanes)?



**MINUTES AND BUSINESS** (10 minutes)

**GETTING ORGANIZED** (10 minutes) page 8

**PLANNING** page 8

The importance of planning ahead can never be overstressed.

**TOOLCHEST AND MATERIALS** page 8

This is not intended to be a complete and thorough coverage of each tool and every material. Rather, it is to serve only as an introduction to the various tools and materials that will be used throughout the club. Hopefully it will leave all members at least knowing what you are referring to when the name of something is mentioned.

To recognize the human resources of the members in the club, and to get a better sense of how much members know, have each member select a tool and briefly tell the rest of the club what they know about it. Add only essential points, or correct any mistakes; give thorough coverage later, when the item is being used.

**TRANSFERRING A PATTERN** (15 minutes) page 8

You need to have thumb tacks or pins, and a sufficient amount of: Copies of a pattern to trace, sheets of carbon paper, pieces of wood (or cardboard for practice) and pencils for all members of the club.

Proceed with instructions in Members' Manual. Before members take the top two pins out of their pattern, check to see that:

- The carbon paper was ink side down
- Any interior lines are done
- Lines are joined and dark enough to see.

Member can practise the technique first and then transfer the pattern for their project if needed.

**M & Ms (MEASURING & MARKING)** (Total: 25 minutes) page 9

**DRAWINGS AND DIMENSIONS** (5 minutes) page 9

Before members can mark out measurements they must know how to interpret the drawing and which dimensions are which. Either photocopy a plan, or have members refer to the drawing on page 9.

Ask members to give you specific measurements regarding width, length, thickness, etc., to ensure they have their dimensions straight and can read a perspective drawing.

### "HANDY" MEASURES (5 minutes) page 10

This is an optional activity which could serve to help familiarize members with the imperial system. It can also help them understand how such seemingly arbitrary measures developed, and that because they are linked to the human anatomy, they still have relevance. Hopefully, the exercise will also sow a seed for the concept of taking the body into account when building for it.

Make copies of the "Handy" Measures Chart (page 26, this Guide) to hand out to each buddy team. Have them take turns measuring and filling in the chart.

### METRIC AND IMPERIAL MEASUREMENT (5 minutes) page 10

Perhaps one of the clearest ways of explaining why the lumber industry has not "gone metric" is to suggest to members that the industry would have to:

- Change all of its equipment and produce stock of different, metric dimensions (expensive, and results in problems with other materials "made to fit"), or
- Simply call what already exists by its metric name.

To illustrate how difficult this second option would be, have members measure 2 x 4" (50 x 100 mm) on a metric ruler. This was chosen because it has been the traditional standard element of the building industry. If you do not have enough 2 x 4"s, use 2 x 6"s (50 x 150 mm), or 1 x 4"s (25 x 100 mm), etc.

You may also have to explain why a 2 x 4" (50 x 100 mm) is not what its name suggests. (Due to the shrinkage of drying, and in some cases the losses of planing, this **nominal** 2 x 4" was the exact size **when sawn**, but is now much smaller.) This will likely be confusing to members, but the same difficulty would hold for material that was cut to metric sizes too.

### WOOD SAMPLE MEASUREMENT (5 minutes)

This exercise is intended to help members feel more comfortable with imperial measures, if only to help them convert to metric. Again, this is an **optional** activity. Do advise your members to stick with one system of measurement once they have begun, since conversions are not always exact.

Photocopy extra copies of the Sample Measurement Chart so that each buddy team has one. Have each team work with a set of four or five samples and measure thickness, width and length in both metric and imperial measurements.

If you want to check on how well members are doing, it would work best if each set is identical, and if the individual samples are labelled A,B,C,D and E. Any size will do, as long as it's not too large. Have some variety, e.g. 2 x 4 x 8" (50 x 100 x 200 mm), 2 x 8 x 10" (50 x 200 x 254 mm), 1 x 4 x 6" (25 x 100 x 152 mm) etc. If necessary, half the members could work on the "Handy" Measures Chart while the others worked on this Chart, if you don't have enough sets of samples to go around.

### MEASURING HINTS (5 minutes) page 10

#### "FOR GOOD MEASURE" CHALLENGE

This simple exercise helps to bring home the idea of how the right tool for the job helps, even if it is only measuring, and how accumulated error can occur.

You need several long pieces of lumber. If you want to check accuracy between groups, have these all the same size. These can be from 5-6½' (approx. 1.5-2 m) You also need a few 12" rulers, a few yard or metre sticks, and a few tape measures.

Divide the club into five or six groups. Give each group one short and one long board and a ruler. Give them a set time to measure the length of the board and write it down, e.g. 60 seconds. Then give them a yard or metre stick. This time give them less time, e.g. 45 seconds. Again have them write the measurement down. Finally, give them a tape measure, and less time, e.g. 30 seconds.

Make sure different members have a chance to measure during the different stages. In each group check to see whether the measurements changed with the tool used. If you began with identical samples, see if the measurements between the groups are the same. If they are not, ask the members why they think that is so.

### OPEN TIME FOR PROJECT WORK (30 minutes)

Members should look at the plans for their project and make sure they understand them. Have them double check the materials list to see if they are forgetting anything. They can transfer the pattern if required and begin measuring.

### CLEAN UP (10 minutes)

### BEFORE THE NEXT MEETING (5 minutes) page 11

If you feel that members could still use some more experience with imperial or metric measures, suggest that they do some measuring at home. Perhaps they can measure some of the articles they found for their Wood Diary. Perhaps they would like to measure several different styles of one thing, e.g. chairs or tables? How similar are these items in dimensions?

REMIND MEMBERS:

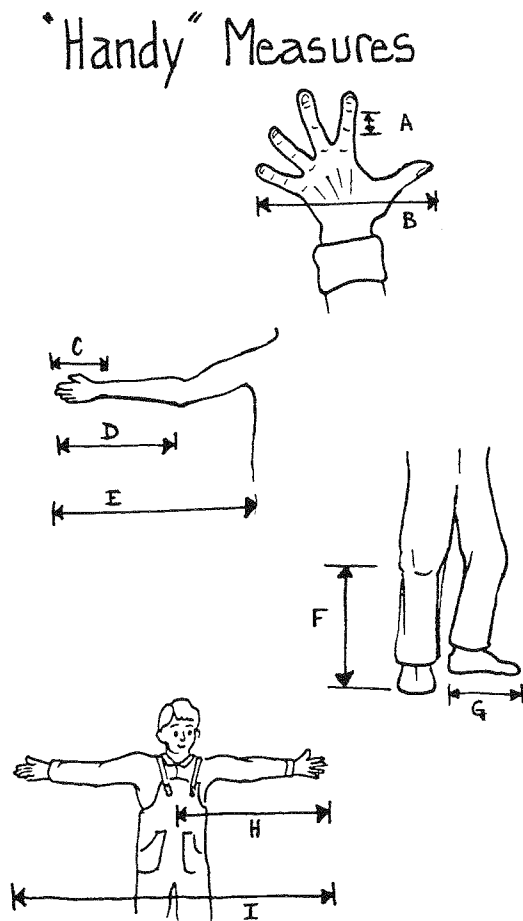
- If they can, bring in the tools and materials listed for the next meeting.
- Ask them to find and bring in a favourite small wooden object from home. For Roll Call they should be prepared to answer the question of why they chose this piece.

QUICK QUIZ (Optional)

Question: When transferring a pattern onto wood using carbon paper, check to see that:

- A. all external lines are there
- B. all interior lines are there
- C. all lines which should connect do so
- D. these lines are dark enough to see when cutting
- E. all of the above.

Answer: E



		Measurements	
Ref.	Name	Imperial	Metric
A			
B			
C			
D			
E			
F			
G			
H			
I			

## **LEVEL II**

### **FACTS AND FIGURES** (10 minutes) page 9

#### **SPECIES: SOFTWOODS AND HARDWOODS**

Divide the club up into three or four groups. Have a set of wood samples organized for each group. Each set should contain about eight samples, and have two or three different **species** of wood, preferably with at least one pair of hardwood and softwood samples.

Have each group work together, and do the "thumb nail" hardness test. This is done by simply pressing the thumb nail across the face of the board. If the surface dents easily, put it in the softwood group, if it is hard to dent, put it in the hardwood pile. But remember this is only a guideline. Some softwoods (Douglas fir) are harder than some hardwoods (basswood and poplar).

A second method to identify softwood and hardwood is by shaving off a small area of the end grain to clearly show the cells. Have members look closely at the end grain and identify the annual rings. Do they also see:

- Thread-like lines which cross the annual rings (found in both hardwoods and softwoods)
- Small, needle-like holes called pores (found only in hardwoods)?

If you want them to try to separate different hardwoods, such as basswood, butternut and maple see if they can determine whether:

- the pores are grouped together or spread around
- the pores are all the same size or different sizes.

### **M & Ms** (Total: 20 minutes) page 10

#### **DRAWINGS AND DIMENSIONS** (10 minutes) page 10

Have members refer to the figure on page 10 of their manual. Ask questions to see if members understand what they are looking at.

If you have brought in a small article, like a box with a handle, illustrate to them what they would be looking at when they refer to top, side and end views.

USING A GRID SYSTEM (10 minutes) page 11

You will need sheets of blank paper or graph paper, pencils and copies of patterns to enlarge.

This is a handy method to remember, although it is likely that an enlarging photocopier would be used these days. Follow the instructions as outlined. Remind members that they can scale up **or** down.

## MEETING THREE

## HIP TO BE SQUARE

### OBJECTIVES FOR THIS MEETING

1. To familiarize members with squares, and have them gain experience using squares.
2. To give members some understanding of lumber's different grains and their individual strengths.
3. To demonstrate the use of various saws and have members gain experience using them.
4. To help members learn to recognize some of the complexities involved in the making of a wooden article, through a judging activity.

### GETTING READY

ACTIVITY	PREPARATION AND EQUIPMENT
Squares	Have squares to show: carpenter's, framing, try, combination, etc.
Using Squares	Squares, pieces of scrap wood, approx. 6-8" (15-20 cm) long, sufficient pieces of paper for each member.
Types of Saws	Have saws to show: crosscut, rip, back and coping.
In The Groove	Saws (preferably crosscut), squares and pencils, C-clamps or vice and four or five pieces of scrap 2 x 4" (50 x 100 mm), approx. 8-10" (20-25 cm) long.
Judging Activity	All (or selected) articles that members brought in for Roll Call. (See page 33, this Guide, for criteria.)
Coping With a Saw	Coping saws, C-clamps or vice, masking tape, pieces of wood with traced patterns or scrap wood.

### **LEVEL II**

Using Squares	Squares (e.g. carpenter's, try, combination, framing), pencil, pieces of wood, several pieces of wood with unjointed edges, (preferably 90 degrees).
Wood Grain & Figure	Have several samples of different woods.
Wood Grain Strength	Piece of wood, approx. 2 x 4" x 4' (50 x 100 mm x 1.2 m), another piece of wood 2 x 4 x 4" (50 x 100 x 100 mm), two bricks or large wooden blocks, large bag of salt for ice melting, hammer and nuts to shell, and a rubber ball.

Getting a Grip	Saws: crosscut, rip, back, coping.
Sawing With a Guide	Crosscut saws, C-clamps and/or vice, pieces of scrap wood with one good straight edge.
Using a Mitre Box	Backsaws, mitre boxes, pieces of scrap wood.
Bench Hook	Bench hook, crosscut saw, scraps of wood, photocopied plans for bench hook.
Interior Cut	Coping Saw, wood with pattern, with pilot hole drilled.

<b>IN A NUTSHELL</b>	
Roll Call	10 min.
Minutes & Business	5 min.
M & Ms - Squares	15 min.
Cutting Comments	30 min.
Judging Activity	15 min.
Project Work	30 min.
Clean Up	10 min.
Before The Next Meeting	5 min.
	<hr/>
	120 min.
Optional:	Level II

**ROLL CALL** (10 minutes) page 12

As members show their favourite wooden items, try to have them explain what it is they like about the item. Perhaps it is the:

- shape
- feel
- figure, pattern, or colour
- how something fits or closes
- overall impression - fineness, worn appearance etc.

**M & Ms** (Total: 15 minutes) page 12

**SQUARES** (5 minutes) page 12

Take just a few minutes to show the different squares, identify the parts, and illustrate the differences.



### "ONE OF FOUR" EXERCISE (5 minutes)

To give members a better sense of how "right" and simple a square can make things fit together have them draw a square, and/or a circle.

Having chosen a set length, e.g. 4" (10cm), use a framing square to draw on the paper. Create a square by pencilling the given length in both directions from a corner of the square. Then set one edge of the square along one of the lines just drawn, at the right length and draw the next line, etc. Continue until the four right angles are made. For a circle, the right angles are drawn so that they connect at a central point. Again, the last line serves as the starting point for the next line. When all four equal lines are drawn, make a freehand curving line to connect the points.

### USING THE SQUARE (5 minutes) page 12

Illustrate how to use the square (see procedure as outlined on page 12). Let members try it themselves. Emphasize:

- How the square is held tightly to the wood
- Where to position the square to ensure the mark will be where you want it, (i.e. allow for the thickness of the pencil's lead)
- Method of double checking for squareness (flip the square to the opposite edge and check to see if the line and blade still line up).

### CUTTING COMMENTS (Total: 30 minutes) page 13

#### TYPES OF SAWS (5 minutes) page 13

Show the different types of saws to the members, and identify parts (toe, blade, teeth, and handle). While discussing saws it is important to mention:

- The teeth must be sharp
- The blade must be straight and clean (free from dirt, rust or grease)
- Like other tools, they must be handled in a safe manner.

Demonstrate safe use of a saw as outlined on page 14.

#### CROSSCUT AND RIPSAW

Show the difference in the teeth – the number, the way they are sharpened and the set.

## BACKSAW

Demonstrate how the back support stiffens the blade. Draw attention to the fact that the blade's top edge is parallel to the teeth. Woodworkers sometimes use this as a reference when wanting to make a cut of uniform depth. Show how the backsaw fits into the mitre box.

## COPING SAW

While showing the coping saw emphasize:

- The fragility of the blade
- The direction the teeth must go in
- The proper tension on the blade.

## IN THE GROOVE - USING A CROSSCUT SAW (10 minutes) page 14

Review the method outlined on page 14. As you work through this procedure, focus on the following points.

- The wood must be securely held, fairly close to the work surface, but not so close that the saw will run into the clamps or the work surface.
- The blade must be properly positioned on the correct side of the cut line. Have members mark "G" for good piece, and "W" for waste piece **before** cutting.
- It is important to start off right – the initial groove sets the path for the whole cut.
- Near the end of the cut, it is necessary to keep the blade straight while sawing.
- It is advantageous to bring your free hand up and over the saw to hold the cutoff end and prevent it from breaking off.

## RELAY SAWING CHALLENGE

As a way of having members try out this skill, divide the club into four or five groups. Each group needs a piece of 2 x 4" (50 x 100 mm), a C-clamp or vice, a crosscut saw, a square and a pencil. Have each team mark a length, e.g. 4" (10 cm) on the board, draw a square line (mark "G" and "W" sides), clamp in place, and cut in a relay. Give each sawyer a set time, e.g. 20 seconds. Consider accuracy of measure (3 points), squareness of the cut – check with square (3

points) and cooperative spirit (3 points) to determine the winning team. Scoring is optional, and if done, it could be by Leader or by other members. If you are short on time, have the 2 x 4"s (50 x 100 mm) pre-marked, and only have members cut.

### COPING WITH A SAW (15 minutes) page 15

The procedure for using the coping saw is outlined on page 15. As you follow through it with members remember to mention:

- Begin and continue with gentle strokes
- Try to hold the saw square to the wood
- To turn, you must slowly rotate the saw in the desired direction, **while** sawing
- When facing sharp angles, it is sometimes necessary to cut entrance and exit kerfs
- To have a finer finish on the bottom side, particularly when cutting plywood, cover the saw's path with masking tape before cutting.

### JUDGING ACTIVITY (15 minutes)

Select four of the articles that were brought in for Roll Call. Members are to select the item that would be the easiest for a beginning woodworker to make. This will be done considering the degree of difficulty of making the item. The easiest will be placed first, the most difficult will be placed last. To try and direct their judgement, have them consider whether the article is difficult because:

- there are a lot of pieces
- there is a lot of tricky work (i.e. several neatly fitting joints)
- there is one very difficult job (i.e. an intricate carving).

### OR

Consider having three or four different styles of wooden chairs on display. Ask members to judge which they think is best, having considered the following:

- sturdiness
- comfort
- attractiveness
- weight.

Ask members which of these considerations is most important to them.

Remember there is a 4-H Judging Handbook (4-H-1550-91) available.

**OPEN TIME FOR PROJECT WORK** (30 minutes)

Members should work on cutting the pieces needed for their project.

**CLEAN UP** (10 minutes)

**BEFORE THE NEXT MEETING** (5 minutes) page 16

Suggest that members work on their sawing skills, before the next meeting. Hopefully, they will have time to finish cutting the pieces they need for their projects.

**REMIND MEMBERS TO**

- Find four or five different shapes of wood, perhaps from objects listed in their wood diary for Roll Call. These should be drawn, described or brought in for display. Have them think about how they were made, and why they are that shape.
- Look through the tools and materials list for the next meeting, and bring in those they have.

**QUICK QUIZ**

Question: When sawing, you **generally** want the kerf on the waste side of the line you measured. True or False?

Answer: True.

## **LEVEL II**

### **M & Ms**

#### **TYPES OF SQUARES** (10 minutes) page 12

##### **TRY SQUARE**

To illustrate the main use of a try square, have several pieces of wood with an unjointed (not 90 degrees) edge. If these step closer to 90 degrees, members will get a better sense of the process involved in preparing a piece for edge gluing. If you cannot get these, find a 1 x 4" (25 x 100 mm) that has a good warp.

##### **COMBINATION SQUARE**

Have members use the mitred angle on the combination square, and mark a corner to be cut later.

##### **FRAMING SQUARE**

To illustrate the greater accuracy of the long framing square, have members use a try square, then a combination square, then a framing square against the corner of a long object (e.g. a table, or a door frame) and judge its squareness.

#### **FACTS AND FIGURES** (Total: 10 minutes) page 12

#### **WOOD GRAIN AND FIGURE** (5 minutes) page 12

Have a variety of wood samples to show to members. With masking tape labels, have them identify the end, side, and face grain. While talking about grain point out:

- Annual growth rings on end grain
- How they help us picture how the board came out of the log
- The direction of the grain
- The figure of the face grain.

#### **GRAIN'S STRENGTH AND WEAKNESS** (5 minutes) page 13

The following are some ideas to demonstrate the different types of strength the different grains have:

- Strength: Place two bricks or blocks on the floor, approx. 3'6" (1.1 m) apart. Before you place the 2 x 4" x 4' (50 x 100 mm x 1.22 m) on them, ask members which would be the best way to carry the weight of the bag of salt – flat or on edge. Perhaps a member might want to stand on the board. Which way will it

deflect noticeably? [We use this fact to advantage when putting 2 x 8" (50 x 200mm) boards on edge as joists to support a floor.]

- **Flex and Resiliency:** Place two bricks on top of one another, and prepare to place the board again. Ask for members' suggestions as to how to set it (which edge up and exactly where to place bricks), if you want to try to use the board to fling a ball. (This principle has been used for diving boards, and for catapults.)
- **Resistance against Compression:** (Use the short piece of hardwood). You want to use the board as a surface to strike on, perhaps to crack a nut. Ask members which grain would show the least impact to being hit. (This is why many wooden mallets and butcher block tables are made of end grain.)

### CUTTING COMMENTS page 14

### SAWING WITH A GUIDE (10 minutes) page 14

This activity is well suited to team work, since it requires a lot of hands. Concentrate on the selection (must have a straight edge) and the placement of the board that is to be the guide, and sufficient tightening of the clamps. Let members try it in a challenge format again if you want. Again, you can score teams for squareness, straightness and cooperative spirit, if you want.

### USING A MITRE BOX (10 minutes) page 15

Demonstrate how a mitre box helps guide the saw, and how best to hold the wood. If you can, clamp the wood in the box. Have members try it too and offer suggestions as they work. (This is an excellent opportunity to have a Youth Leader demonstrate.)

### BENCH HOOK (5 minutes) page 15

If possible, show members what a bench hook is. Illustrate how it is used to help hold the work piece against the movement of the saw. If any members are interested in building a bench hook, have copies of some plans available.

### MAKING AN INTERIOR CUT WITH A COPING SAW (10 minutes) page 15

When demonstrating this method, emphasize the following:

- The hole is to be drilled on the **waste** side
- Holes can also be useful for turning your blade around sharp corners
- Show how to correctly secure and tension the blade.

The method otherwise is the same as for any cut with a saw, except for releasing the blade and taking it out again.

## MEETING FOUR

## PUTTING IT TOGETHER I

### OBJECTIVES FOR THIS MEETING

1. To demonstrate, and have members try basic hammer skills, e.g. starting, driving and pulling out nails.
2. To improve members' understanding of how and why wood moves, i.e. shrinking and swelling, and the problems this can cause.
3. To familiarize members with the wide range of nails available and help them understand how to decide what to use.
4. To demonstrate the safe use of the electric drill and have members try it.

### GETTING READY

ACTIVITY	PREPARATION AND EQUIPMENT
Roll Call	Have several examples of articles where the shape of the wood has been altered: e.g. turned spindle, carved claw, raised door panel, picture frame with shaped profile, bow back or pressed back of a chair.
Hammer Skills	Have hammers, goggles, a selection of nails of various types – lengths from 3/4-4" (19-100 mm), rectangular pieces of light cardboard (1 x 2", approx. 25 x 50 mm), pieces of scrap softwood and hardwood, electric drill and appropriate drill bits, scratch awl, C-clamp or vice and sections of a large log.
Types of Nails	Have full selection of nail sizes and types, including brads, finishing, common, flooring, as well as ardox and galvanized.
Choosing Nails	Have nail selection as above, goggles, pieces of scrap wood (some the same thickness, some different).
Electric Drill	Electric drill, bits and chuck key, goggles, nails, pieces of scrap wood (including some hardwoods).

### **LEVEL II**

More Nailing Skills	Have goggles, hammers, various nails, pencils, square and pieces of scrap wood.
Natural Wood Movement	Have samples of woods showing various types of warps and end grain clearly showing difference between spring and summerwood. Also have edge grained and flat grained wood. (Optional exercise: use last two samples; pail, weight).

- Removing Dents                      Have several cloths, approx. 4-5" (10-12.5 cm) square, small containers for water, iron, hammer and pieces of wood, 1 x 4 x 12" (2.5 x 5 x 30 cm).
- Wood Shrinkage                      Have examples of wood: freshly cut 2 x 4" (50 x 100 mm), full size and weight, lumber yard 2 x 4", warped boards.

<b>IN A NUTSHELL</b>	
Roll Call	10 min.
Minutes and Business	5 min.
Joining Wood – Hammer	20 min.
Project Work <u>or</u> Practice	15 min.
Nails	10 min.
Electric Drill	20 min.
Project Work	30 min.
Clean Up	10 min.
Before The Next Meeting	5 min.
	<hr/>
	125 min.
Optional:    Level II	

**ROLL CALL** (10 minutes) page 17

Ask members to show the different shapes they found. Have some samples on hand yourself, in case they have not come up with much. As the objects or drawings are shown, or the description is given, here are some questions you can pose to members.

Any ideas on how that shape has been made? Suggest:

- Saw cut, e.g. bevelled panel, curving shape of chair arm, or rounded edge of table
- Carved, e.g. chip carved lid, or claw foot
- Turned into round form, e.g. table leg, candlestick
- Shaped by a spinning cutter like router, e.g. picture frame moulding
- A combination of more than one of these.



Why has the wood been shaped that way? Suggest it is to:

- Be attractive or fancy
- Prevent injury, i.e. bevelled edges or rounded legs of table
- Reduce weight where it serves no purpose, e.g. cut out design of a chair arm
- Make a joint, e.g. raised panel of door (using wood the same thickness).

### BUSINESS AND MINUTES (5 minutes)

#### JOINING WOOD (Total: 20 minutes) page 17

#### HAMMER SAFETY (5 minutes) page 17

After showing the different parts of the hammer, concentrate on hammer safety. It is essential to cover these three points.

- Secure hammer head. Have a secure and insecure head to show.
- Goggles must be on when **anyone** is hammering.
- Hair and earrings etc., must be out of harm's way.

#### HANDLING THE HAMMER (5 minutes) page 17

Have all members pick up their hammers. Make sure goggles are on! Walk around and see if they are gripping them towards the bottom of the handle. Have them try to start a nail. After a minute or two, demonstrate the proper location of the grip. Explain how it provides more power, and that soon they will have proper control.

To help members understand the difference in the way they can make their swings, demonstrate the following. Hold a hammer, and have your arm up in the air, as you do the following.

- Move only your **wrist and hand**; emphasize how restricted the movement is, and how little power you can exert.
- Move from your **elbow** down only (you might want to hold your elbow with your other hand, to prevent unwanted movement); show the greater range of movement and speed.
- Move your **entire arm**, from the shoulder down and point out the full force you can now exert.

#### HAMMER HINTS (10 minutes) page 18

The procedure for Starting, Driving and Pulling out nails is outlined in the manual. Demonstrate these to the members. After showing each skill, you may want to use an activity to practise it, or you might prefer to use the practice time to work on projects. Suggestions for practice activities are below.

## PROJECT WORK (15 minutes)

OR

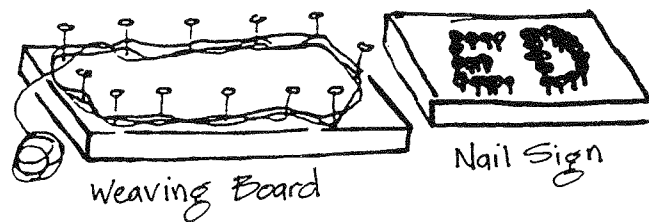
## PRACTICE (15 minutes)

### STARTING NAILS

To practice holding and beginning a nail, you can have members work on a nail point design. For this, each member would require goggles, hammer, some nails (1", 2" and 3"), a piece of 1 x 6" pine (approx. 5 1/2" long, cut and sanded), and a pattern to copy on this block. By using the different size of nails, the members create a picture using the holes of the nail points.

OR

You might want to simply have members hammer nails repeatedly into the end of a log (softwood would be easiest), or create a nail sign using nails to 'write' their name, or hammer nails into a board so that they can 'weave' yarn in and out of the nails.



### DRIVING NAILS

If you have access to three or four sections of logs, you can run a nail driving contest. Divide the club into three or four groups. Each group needs one or two hammers, a good supply of nails [all the same size, i.e. 2 1/2", (63.5 mm)], goggles, and a log. Give the teams a set time, e.g. 3 minutes, to drive as many nails in as they can. Only one member per team can work at one time, and each member of the team must get a try. Bent nails will cost points. Score each team's performance: every member got a good chance (4 points per member), nails driven all the way (3 points for each), nails about halfway in (2 point), bent nails (-1 point).

### PULLING NAILS OUT

Have the same teams return to their logs for a nail pulling relay. In addition to the logs with the nails, you will need hammers, goggles and a few pieces of scrap wood of different thickness (a set for every team). Again give them a set time (e.g. 3 minutes), to pull out as many nails as they can. Mishaps or injuries will cost points. Once again, score each team's performance: every member got a good chance (4 points per member), nails pulled all the way out (3 points), nails only partially pulled out (2 points), any mishap or injury (-1 point).

**N.B.** You may wish to have members rate themselves, or another group for these relays.

**NAILS** (10 minutes) page 19

### TYPES OF NAILS

It is important to have a good range of nail sizes, eg. from 1/2 to 6", 12.7-152 mm), as well as types (check those covered on page 19) to show them. You might want to prepare a board with the different nails mounted and labelled. You might want to mount screws on the same board. Emphasize that for most of their work they will want:

- brad nails
- finishing nails
- common nails.

Occasionally, they may want:

- the ardox type (spiralled) for greater holding power
- galvanized, for wet situations.

### CHOOSING THE RIGHT NAIL

Have a selection of different pieces of scrap wood of different thickness, if you can. Also have goggles, hammer and a wide selection of nails. Have members select two pieces and then select the nails they would use. After members have chosen, have each of them stack the pieces, and try to nail them together. You may want to protect worktops with extra pieces of scrap wood. Discuss the choices made.

- How many were just right? Point these out and why they worked well.
- Were some nails too short? Ask members if using more makes any difference.
- Were some too long? Suggest that these can be clinched?
- Did some of the wood split when it was nailed? You might suggest more careful placement (i.e. set in from edges and offsetting the nails), right size of nails, etc.

### THE ELECTRIC DRILL (Total: 20 minutes)

#### PARTS OF THE DRILL AND SAFETY (5 minutes) page 21

Briefly outline the various parts of the electric drill. Highlight the bits and how to tighten the chuck, at **each** keyhole. For members who have access to hand drills, the process is the same, except there is no need for the cautions that come with electricity.

Remind members of:

- The standard safety concerns
- The added concerns because of electrical power
- The added concerns because the tool spins around.

You might divide the club into two. One half would form two or three groups who prepare to drill. The other half form two or three observer groups. At the end of a set time, e.g. 2 minutes, have the observers give their analysis on the safety of the action teams, as they go through the following.

### DRILLING HOLES (10 minutes) page 22

Run through the procedure as outlined. Once it is certain that members are working safely, concentrate on the following points.

- Progress slowly and steadily, pulling up occasionally to let the shaving out.
- Hold the bit square to the board and **do not** put sideways pressure on the bit.
- Use a line of masking tape around the drill bit to act as a depth guide.
- Reduce the roughness of the bottom edge by having scrap wood clamped tightly underneath it, and ease through gently.

### PROJECT WORK (30 minutes)

### CLEAN UP (10 minutes)

### BEFORE THE NEXT MEETING (5 minutes) page 22

Suggest that members work on their nailing skill before the club meets again. They should try and do all the nailing required on their project.

### REMIND MEMBERS

- To consider the question posed for Roll Call.
- To check the tools and materials required and bring in those they can.

### QUICK QUIZ

Question: Skill at hammering depends on two things. What are they?  
Answer: The grip and the swing.

## **LEVEL II**

### **JOINING WOOD** page 17

#### **HAMMER SKILLS** (Total: 15 minutes)

#### **STRAIGHTENING NAILS OUT** (5 minutes) page 17

This is not an easy skill. Emphasize the following.

- Positioning the work so that you can get a good swing to hit the nail on its side helps.
- Hammering a bouncing nail is not any easier than hammering a bouncing board, that is why a block of wood is used to nail against when most of the nail is exposed.

#### **CLINCHING NAILS** (5 minutes) page 17

Emphasize these points.

- Clinching can greatly increase the strength of the joint, i.e. the nail has far greater holding power.
- Changing the position of the work piece, if you can, will often improve your swing.

#### **TOE-NAILING** (5 minutes) page 18

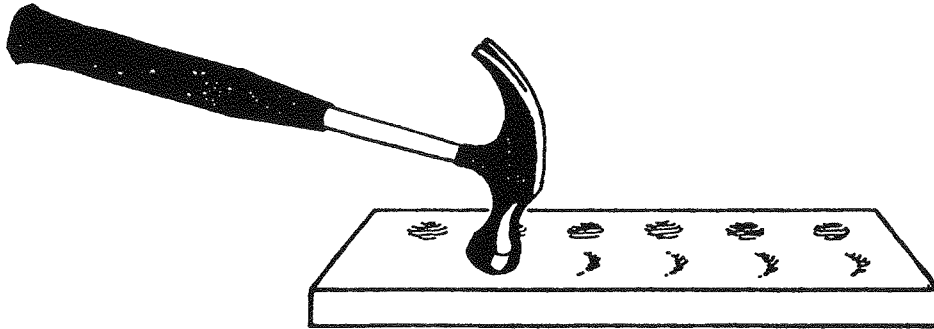
Emphasize that the main difficulty with this procedure is that the one board (the vertical part of the "T") wants to shift sideways as you nail. To reduce this problem do the following.

- Start with the board offset by 5 mm (3/16") in the opposite direction. Have location of board drawn with square.
- Once the nails on the one side start to bite, and the board is lined up, start the nails on the opposite side to help hold it in place.

#### **REMOVING DENTS** (10 minutes) page 18

The basic procedure is outlined on page 18. If you want, you could try the following activity to give members a better sense of the degrees of difficulty they could encounter, and how well the different approaches work in different circumstances.

Activity: Along the long edge of a piece of wood make two shallow, two medium and two deep full-faced dents. (Try to space these out equally so you can separate your treatments). Along the opposite edge, place six dents of like depth, but make these crescent-shaped by using only the edge of the hammer face. With one of each "pair" try the wetting technique only. With the other of each "pair," use water and the hot iron. Repeat when necessary. You may want to have members make a chart to record the treatments and their effectiveness.



**FACTS AND FIGURES** (30 minutes) page 19

**WOOD MOVEMENT - SHRINKING** (5 minutes) page 19

Have as many examples as you can of drying defects to show to members. These include checks, bow, twist, cup, wind and crook, (see illustrations on page 19). As they look at these explain the following points.

- The free water in the tree is dried without shrinkage.
- Only when the cellular moisture is being lost, does shrinkage and possibly warping occur.
- Certain woods are more prone to drying problems.

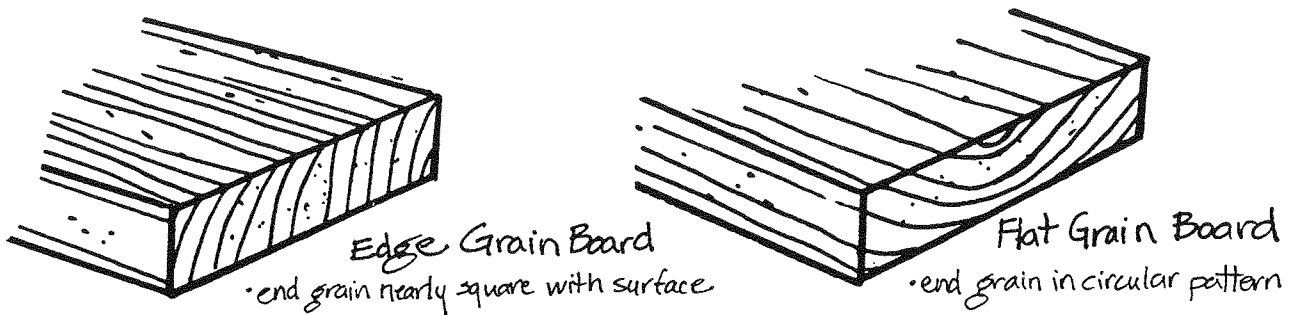
**NATURAL WOOD MOVEMENT** (15 minutes) page 19

Have samples of wooden articles to illustrate where side and end grain have been permanently joined, and warping and splitting have resulted. Table tops are often joined to the supporting aprons incorrectly.

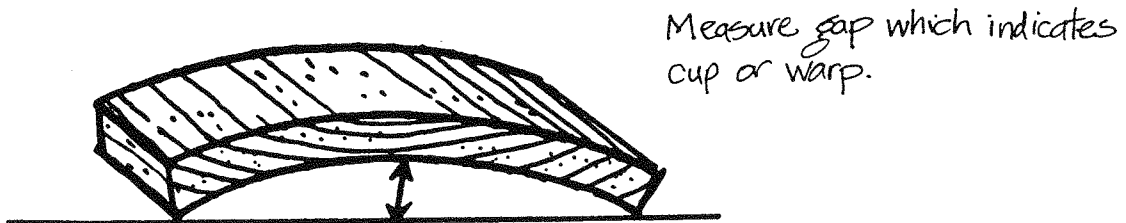
**SHRINKING, SWELLING AND WARPING ACTIVITY**

- AIM:
- This exercise gives members a chance to observe the shrinking and swelling of wood with changes in moisture. They will also see the effect of wood grain direction on warping. Although it takes two or three weeks to complete this exercise, the actual preparation time required is little.

- NEED:
- One piece of edge-grained wood and one piece of flat-grained wood is needed. These should be dry to the touch, and be of the same species and the same size, e.g. 1 x 8 x 4" (25 x 200 x 100 mm).
  - A safe spot where the samples can dry.
  - Square or ruler.
  - Cloth to wipe down wet pieces of wood.
  - A pail with water.
  - A weight like a brick or stone.



- DO:
- Have members place the **flat** grain piece on a flat surface, and measure any cup and record this on a chart. Have them measure the width of the board to the closest millimetre.



- Do the same with the **edge** grain piece.
- Dry both pieces and then re-measure. (In summer, pieces can be put where they will get sunshine and wind for 2-3 days. In winter, the pieces can be placed near a register, stove or radiator to dry for 5-7 days). Check the same measurements of the cup and width for both pieces.
- Wet both pieces and then re-measure. Immerse the pieces in water, under the weight, for 24 hours. After removing them, wipe off excess moisture with the cloth. Record the cup and width measurements.

ASK:

- Which piece curved the most as it dried?
- Did the pieces straighten up when they were wet? Both?
- What was the difference in width between dry and wet?
- Would edge grain or flat grain lumber be best to work with?

### SHRINKING, SWELLING & WARPING CHART

	Edge grain	Flat grain
<b>Step 1-as it comes from the lumberyard</b>		
<b>Width</b>		
<b>Cup</b>		
<b>Step 2-after more drying</b>		
<b>Width</b>		
<b>Cup</b>		
<b>Step 3-Wet</b>		
<b>Width</b>		
<b>Cup</b>		



## MEETING FIVE

## PUTTING IT TOGETHER II

### OBJECTIVES FOR THIS MEETING

1. To introduce members to the use of screws for joining wood and try their drilling skills at the same time.
2. To give members some understanding of glues and how to work with them through hands-on experience.
3. To give members some understanding of how different species of wood vary and how to use them.

### GETTING READY

ACTIVITY	PREPARATION AND EQUIPMENT
Roll Call	Have samples such as maple syrup, birch bark basket, pictures of wooden ships, wagons, carts, train tracks and rails, beaver, log home etc. to illustrate just how frequently wood figured in our past.
Screws	Drill and correctly-sized bits, screws of various sizes and types (you might want to mount these on a board for display), safety goggles or glasses, scrap wood including some hardwoods.
Glues & Gluing	Have samples where glue has been used on a joint by itself, or to hold fasteners like dowels. Have containers of white (e.g. Elmer's), and Carpenter's or yellow glue, spreaders, pieces of wood prepared for gluing, C- or other clamps, vice or a weight like a brick and a clean cloth.

### **LEVEL II**

Glues	Sample of plastic resin and resorcinol glues.
Gluing Up Boards	Have glue, spreader, 3 pipe clamps, three boards prepared for gluing. Of the boards, two are jointed on one long edge and one is jointed on both long edges. Also needed are small scraps of wood to place between the clamp and the wood.

Qualities of Wood	Have samples of wood to exhibit differences. To show strength have a piece of oak and pine, 1 x 4" x 4' (25 x 100 mm x 1.2 m). Also needed are two bricks, a C-clamp and one person. To show hardness, have a piece of maple or cherry and basswood. To show workability a piece of basswood and elm or hickory, etc., is needed. Also have samples of ash, beech, birch and walnut.
Strength of Joints	If possible, have samples showing use of glue, nails, dowels, screws, splines and some samples of joints (butt, mitre, rabbet, lap, dovetail etc.).
Dowelling	Electric drill, grooved dowels, bits sized for the dowels, masking tape, wedges for dowels, pieces of scrap wood.

## **PROJECT COMPLETION**

Read the note on page 61, this Guide. If you want members and parents/guardians to complete the Project Summary sheet, copies should be given out at this meeting.

<b>IN A NUTSHELL</b>	
Roll Call & History	10 min.
Minutes and Business	5 min.
Joining Wood With Screws	15 min.
Joining Wood With Glue	20 min.
Project Work or Practice	20 min.
Project Work	35 min.
Clean Up	10 min.
Before the Next Meeting	5 min.
	<hr/>
	120 min.
Optional:	Level II

### **ROLL CALL AND WOOD IN CANADA'S HISTORY** (10 minutes) page 23

Here are some ways you could convey the role wood and trees played in the history of this country.

- Have lots of illustrations in books and magazines of canoes, wooden ships, wagons, train rails and ties, log cabins, etc. Even if they are only in books, the message will come across that wood played a large role in our past.
- Try to find some wooden items that settlers used, e.g. wooden bowls, wooden shovel or hay fork. Choosing items which today are made from other materials will help emphasize the availability of wood. (You might want to discuss whether other materials are better, e.g. glass, ceramics or plastic for bowls, steel for hay forks, etc.).
- Trees used as indicators of other resources: The black walnut was used to indicate deep, rich soil by the Pennsylvania Dutch. Their settlement mirrored its presence. Perhaps members can think of other examples.

### **MINUTES AND BUSINESS** (5 minutes)

### **JOINING WOOD WITH SCREWS** (Total: 15 minutes)

#### **INTRODUCTION AND TYPES** (5 minutes) page 24

Have a wide selection of screws to show members. If you can, have them mounted on a board and identified so that members can see the difference in the driver patterns, the shape of the heads and also the number sizes and their respective lengths.

#### **WORKING WITH SCREWS** (10 minutes) page 24

It is important to draw the members' attention to the following.

- The different shape of the heads, which are countersunk and why, and how this changes the length going into the wood.
- The numbering system, and how the lengths available vary. Give members some ideas of which are typical selections for their needs.
- The different driver patterns, different sizes and matching drivers. Perhaps have samples of each started in a piece of wood so members can try driving them in to see which they prefer to use.

### JOINING WOOD WITH GLUE (Total: 20 minutes) page 27

Ask members what they think some of the ingredients of glue have been in the past. They may be surprised to learn what has been or is being used, see page 27. As you discuss glues, focus on the following.

- The most common types, such as white and carpenter's glue, and the fact they are the safest and easiest to use.
- Glues do not suit every purpose, some are not waterproof, others stretch, others will not take a stain. Be sure they pick the right glue for the job.

### WHY GLUE (5 minutes) page 27

Ask members to think of the reasons why glue is used. Perhaps you might want to have two or three teams form, and each team comes up with as many reasons as they can, within a time limit, (e.g. two minutes).

To give members a good idea of when glue is used, have a variety of examples to show. Samples could include two boards glued with:

- flat sides together, with grain running parallel,
- flat sides together, but with grains running at right angles to each other,
- edge grain to edge grain,
- face grain of one, to end grain of another, perhaps continuing on to make a box,
- above examples, but using different wood(s) and/or plywood.

### GLUING PROCEDURE (10 minutes) page 27

If you begin by explaining how the glue works, the steps outlined in the procedure will make sense. Emphasize:

- The necessity of having the joints properly prepared,
- The value in doing a "test run" to ensure all the pieces are there and everything fits,
- The need for good, but not excessive pressure on the two pieces while the glue dries. Warn members that too much pressure can drive **all** the glue out, and lead to failure.

You may glue up scrap boards, or you might use one of the member's project pieces to illustrate the above process.

**PROJECT WORK** (20 minutes)

**OR**

**PRACTICE** (20 minutes each)

This is open time for each member to try his/her hand at using screws or the gluing process. Rather than working just on a practice piece, they may want to work on their projects.

Suggest to members that this is a golden opportunity to take advantage of buddy teams. At several stages of gluing (e.g. Thinking it Through, Holding All the Pieces etc.) two people working together will accomplish much more.

**CLEAN UP** (10 minutes)

**BEFORE THE NEXT MEETING** (Total: 5 minutes) page 28

Suggest that members may need to do more gluing or drilling before the next meeting. As this is likely the last meeting coming up, efforts to get projects ready for finishing would be wise.

**REMIND MEMBERS**

- Be on the look out for types of joints (perhaps in their wood diary articles) for Roll Call. These can be named, described or drawn.
- Check out tools and materials required for the next meeting and bring those they have.

**QUICK QUIZ**

Question: Glue is used to:

- A. make stronger joints and members
- B. make larger stock
- C. create certain visual effects
- D. only A and B are true
- E. A, B and C are true.

Answer: E

## LEVEL II

### GLUING WIDE BOARDS (10 minute) page 22

Convey these important points to members.

- In many regards, this is a fairly difficult gluing situation. Not only are you trying to match the boards end-to-end, but you are also trying to place them so they make a flat horizontal surface.
- The dry lay-up and pre-marking "X"s for alignment are very important. Not only will this serve to familiarize members with the steps, but it also ensures you have everything you need and that everything will fit.
- The arrangement of the boards is critical too. If flat-grained boards have their end grain alternately cupped up and then down, the stresses equal out and warping is minimized. Check this during the "test run."
- Wiping up the excess glue while it is still wet, saves a difficult job later on.

### FACTS AND FIGURES (Total: 20 minutes) page 23

#### QUALITIES OF WOOD (10 minutes)

Begin by asking members how many different qualities of wood they can think of. Perhaps by suggesting the different uses we put wood to, that may help them consider certain qualities. These probing questions may help.

- Carvers use wooden mallets to pound chisels. What quality is needed?
- Very different woods are used for carving decoys. What is essential? Is **even** grain, where the growth rings are hardly noticeable, or **uneven** grain wanted?
- Fence Poles are out in all kinds of weather. What quality is needed?
- Heavy, large beams hold up huge old barns. This job requires what quality?

Try to illustrate some of these different qualities as you talk about them.

- For **strength** you might have the 1 x 4" x 4' piece of oak suspended between the two bricks, and have a **light** member of the group stand on it. Is it safe to try the same thing with pine?
- For **hardness** snug a C-clamp on a piece of cherry or maple and give it three more turns. Repeat with basswood or pine. Compare dents.
- For **workability** you might give members a carving tool and a piece of basswood, then a piece of elm or hickory. Do they feel and see much difference?

#### QUALITIES OF SOME SPECIES (10 minutes) page 23

Ask members these questions.

- Were there any woods in the articles of their wood diaries that they recognized.

- If so, what were they and what were the objects made from them?
- Were there objects made of more than one wood? Any ideas why? (This is common in chairs – carved seat of pine, an ash bowback and turned legs and spindles of beech.)
- Did there appear to be a specific reason for their use in that particular article?

If you are able, have samples of some of the woods mentioned, e.g. ash, beech, birch, oak and walnut. Point out:

- The springy quality of the ash
- The fineness of the beech
- The hard, toughness of birch
- The heaviness and strength of the oak
- The obvious fine finish qualities of the walnut.

### JOINING WOOD (Total: 35 minutes) page 24

#### FASTENERS AND JOINTS (10 minutes) page 24

Ask members how well they think the methods work for joining wood? While you discuss the drawbacks of the different ways already used to join wood, e.g. nails and glue, have samples to illustrate some of the problems, e.g. nailed joint's strength against a pull straight out.

Ask members for their own ideas on what else we can do to try and improve the strength of a connection. If possible, have examples of these options too, e.g. dowels, splines, screws and a selection of joints.

#### DOWELLING and HOW TO DOWEL (10 minutes) page 25

A project to put dowelling to good use in is the bench hook. The method is outlined in detail. Focus on these points.

- The drill bit must be sized to produce a **snug** fit for the dowel.
- A grooved dowel, and chamfering the hole edges on the sides that meet help to equalize glue pressure.
- The dowel should be driven in without a break, so it does not stop and seize. (Chamfering the leading edge of the dowel helps drive it in easier too.)
- If members want to wedge the dowel in place, it is critical they wedge in the correct direction, i.e. at right angles to the grain.

#### TYPES OF JOINTS (15 minutes) page 26

Cover why joinery is of value. Display some of the basic types of joints. Work with those members who are trying to make these joints.

## MEETING SIX

## FINISHING TOUCHES

### OBJECTIVES FOR THIS MEETING

1. To have members gain experience at the basics of hand sanding.
2. To give members a better understanding of our wood resources, and some concept of our future options.
3. To have members gain some understanding of finishes, and their use, particularly a penetrating oil finish.

### GETTING READY

ACTIVITY	PREPARATION AND EQUIPMENT
Roll Call	If you can, have articles which show some of the different joints: butt, mitre, dovetail, dowelled, lap, etc.
Hand Sanding	Have pieces of wood to sand such as scraps (pine is best) or project parts. Have a selection of sandpaper various grits (from #80-340), and from various materials (garnet, aluminium oxide, silicon-carbide). Also needed are steel wool (grade 00 to 0000), goggles, sanding blocks, C-clamp, and plywood with a piece of sandpaper glued to it.
Finishes	If possible, have various samples of finishes, either the containers with instructions, and/or wooden articles that illustrate some of these finishes (e.g. stain, oil, varnish and paint).
Using An Oil Finish	Have clean cloths, oil finish, projects to finish, silicon-carbide paper (340 grit) and/or steel wool (grade 0000), glasses or goggles, paint brush (45mm, 1 1/2"), rubber or latex gloves.

### **LEVEL II**

Electric Sander	If possible, have samples of electric sanders: straight and orbital, a few sheets of different grades of sandpaper, goggles, C-clamp or vice and scissors.
Wood's Future Role	If possible, have a few items in both wood and plastic or metal. Have a young tree in a container. A section of log, pieces of lumber, plywood, waferboard and particleboard, samples of wood, plastic and metal garbage can be displayed.



**Decorative Techniques** Have samples of some of the following: folk art painting, stencilling, wood burning, splattered and sponged finishes to display. To try some of these have paint, pieces of marine sponge, foam, clean rags, a few pre-painted pieces of wood, a plastic drop sheet, aluminium pie plates, a few brushes, permanent markers, piece of wood with design on it and acrylic sealer.

<b>IN A NUTSHELL</b>	
Roll Call	10 min.
Minutes and Business	5 min.
Hand Sanding	15 min.
Project Work	25 min.
Wood Finishes	20 min.
Project Work	30 min.
Clean Up	10 min.
Before the Achievement Program	5 min.
	<hr/>
	120 min.
Optional: Level II	

**ROLL CALL** (10 minutes) page 29

If you have samples of some of the joints, display them. See if the members found any like the ones on display. If not, ask them to describe or illustrate the joints they found. Could they see all the joints, or were some hidden?

**MINUTES AND BUSINESS** (5 minutes)

**HAND SANDING** (Total: 15 minutes) page 29

**TYPES OF SANDPAPER** (5 minutes) page 29

Concentrate on the differences.

- Grits: Have the members feel the difference between #80, 150 and 220.

- Materials: Display flint, garnet, aluminum oxide, silicon-carbide papers
- Coats: Show and discuss open-coat – best for resinous woods, and closed-coat – best for fast general purpose work.

### SANDING TRIAL (5 minutes) page 29

This is an opportunity for members to explore tools and their effects without direction and instructions. Let them try every grade of sandpaper, in any order, and in any direction. Just ask them to keep track of what they do, so they will connect their action with each effect. Members might want to mark their trials with a number, and on a piece of paper mark the number and the corresponding treatment (e.g. 80 grit used with the grain).

### SANDING TIPS (5 minutes) page 29

There are a number of tips covered in the Members' Manual. Here are a few you may want to highlight.

- Direction of Sanding: Always sand **with** the grain.
- Progressing Through the Grades: Always go from coarse or medium to fine and extra fine. Most of the time 180 or 200 grit produces a fine enough finish.
- Sanding Block: It makes the job faster and prevents scratching.
- Sanding Small Items: Sandpaper glued permanently on plywood board makes the job much easier.
- Final Checking for Smoothness: This is best done by feel (use the finger tips).
- Emphasize that taking time now, and doing a good job of sanding will really show the time, effort and workmanship they have put into their projects.

### PROJECT WORK (25 minutes)

Continue or begin sanding their projects.

### WOOD FINISHES (20 minutes) page 31

Emphasize that there are two basic ways to describe wood finishes:

- The kind of job they perform, i.e. protective or pretty

- The manner in which they do that job, i.e. penetrating into, or making a surface on top of, the wood.

When covering the different types of wood finishes, it is important to note the following.

- Good ventilation is very important with most finishing products for safety sake.
- Use rubber gloves to protect hands from finishes.
- Properly dispose of any rags.
- For best results, finishing efforts should be separated from other woodworking tasks like sanding and sawing that create dust. If this is not possible, try to keep the environment as clean as you can.

### USING OIL FINISHES

If possible, use the members' projects while following the directions given for using an oil finish. Keep in mind that the drying times are approximate, and the temperature and humidity can alter these quite a bit.

### PROJECT WORK (30 minutes)

Continue sanding or finishing projects. If members are working on both tasks, separate work areas will be needed.

### CLEAN UP (10 minutes)

### BEFORE THE ACHIEVEMENT PROGRAM (5 minutes)

Review the details for the Achievement Program to be sure each member is aware of his or her responsibilities.

### QUICK QUIZ

Question: The numbering system used with sandpapers refers to the grit size. The smaller the grit size, the smaller (lower) the number. True or false?

Answer: False.

## **LEVEL II**

### **THE ELECTRIC SANDER** (Total: 15 minutes) page 29

#### **TYPES OF ELECTRIC SANDERS** (5 minutes) page 29

Identify the two main types of sanders, and display a sample of each, if you can. To demonstrate the action of each, put a fairly coarse sandpaper in, and let members try each on a piece of pine or other soft wood which has been clamped or wedged in place.

#### **USING THE ELECTRIC SANDER** (10 minutes) page 29

Before letting members try these tools on their own, cover the following.

- Safety concerns, again because they are dealing with an electric tool and one with abrasive power that could really damage skin.
- Demonstrating how the paper is put in and held.
- The proper way to start and stop, and the motion to use while working.

### **FACTS AND FIGURES** (page 30)

#### **WOOD'S FUTURE ROLE** (15 minutes) page 30

Have members close their eyes and count out ten seconds. Explain to them that during those few seconds forests covering ten football fields have been cut.

The best ways we can help to preserve our wood resources are:

- To reduce our demands
- Recycle all wood resources we can
- Help to re-establish forests.

Ask members to think seriously about ways in which they can do something positive to preserve this resource.

Have one or two items, in both wood and a second material, e.g. plastic or metal. Suggestions include chairs, table, toys etc. Ask members which they prefer and why. Consider appearance, feel and comfort (in all seasons). Which do they think will last longer?

One of the most effective ways you can display some of wood's positive features is to have: a young tree growing in a pot, a section of log, a squared balk and lumber, as well as plywood, waferboard and/or particle board. Discuss with members:

- The relatively simple process that makes lumber and wood products from trees
- The relatively quick renewal of the resource (compared to oil used in plastic production).

Have members look over the garbage samples you brought in. Ask them to consider which:

- will decompose
- can be reasonably recycled
- is being generated the fastest?

Have members think about actions they can take to improve the situation. Ask for their suggestions.

## **OTHER DECORATIVE TECHNIQUES** page 32

### **PAINT MAGIC** (15 minutes) page 32

Several techniques can be covered. Some of the simplest and quickest include splattering, sponging and rag rolling.

To try these techniques with members, have some pre-painted wooden pieces, a plastic drop sheet, some latex paint, a few small paint brushes, one or two flat pans for holding paint (e.g. aluminium pie plate), marine sponges or foam and some clean rags. A brief outline is provided in the Level II manual.

## **PROJECT COMPLETION**

A Certificate of Completion and a Project Summary have been included in this Guide, pages 62-63. Your signature on either of these indicates you feel the member has completed the project to the best of his/her ability. Space is provided for you to add some individual comments to offer encouragement to the member. The Project Summary sheet also asks for written feedback from the member and his/her parents/guardians. (The questions on this sheet have been selected from the informal evaluation sentences, listed below.) Select whichever sheet best meets your needs and make copies for the members.

## **INFORMAL EVALUATION**

Take a few minutes at the last meeting to do an informal evaluation with members. One way to do this is to ask them to complete one/all of the following sentences.

- I joined this club because ...
- I really enjoyed ...
- I didn't enjoy ...
- I had a hard time ...
- My favourite meeting activity was ...
- My least favourite meeting activity was ...
- If I was to take this project again, I would change ...
- I learned ...
- I've changed ...
- I'm glad ...

## **IT WORKED FOR US!**

Your experience in leading this club would be helpful to another leader in your area. You are encouraged to make some comments about the project, what resources you discovered locally and the members' feelings about the project and pass this information on to your 4-H Association. The Resource Development Committee of the Ontario 4-H Council is interested in your comments too. Their address is in your Leaders' Guide, page 11.

**THANK YOU FOR BEING  
A VOLUNTEER 4-H LEADER!**



# WOODWORKING

Congratulations on successfully completing  
this 4-H project.

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\_\_\_\_\_  
Date

\_\_\_\_\_  
Club Leader's Signature

# Woodworking

## Level I



Name \_\_\_\_\_ Age \_\_\_\_\_

Club \_\_\_\_\_



4-H 2490 94 MIE



# THE 4-H PLEDGE

"I pledge:  
My Head to clearer thinking  
My Heart to greater loyalty  
My Hands to larger service  
My Health to better living  
For my club, my community and my country."

## TABLE OF CONTENTS

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Agriculture, Food and Rural Affairs and Agriculture and Agri-Food Canada.

*The primary purpose of the 4-H program is the personal development of youth in rural Ontario.*

## ***Introduction***

Welcome to the 4-H Woodworking project. Each of you has come with different skills and ideas of what you would like to learn. Great! Hopefully all members will find the project enjoyable and rewarding. And, having different skills you will all be a help to each other.

Wood has been a valuable resource for our country since pioneer times. As a material it remains easy-to-use, relatively cheap, and fairly versatile. This means woodworking can be a handy skill to have. During the project you will have a chance to try, or perhaps improve, skills such as sawing, hammering, drilling, gluing and clamping.

Throughout the project you will also learn about some of the properties of wood. You will find out how lumber is described – by category, size, species and grade. Information about basic properties such as grain, hardness and suitability for certain jobs is also included. Most of this helps us understand why wood behaves the way it does, and how to work with it best.

## ***Objectives***

As a member of this project we hope you have fun as you develop some understanding of:

- Wood's basic properties;
- How different woods vary and why they are used the way they are;
- The skills required to work with wood;
- The importance of wood in both the manmade and natural environment.

## ***General Requirements***

A member will complete a project satisfactorily by:

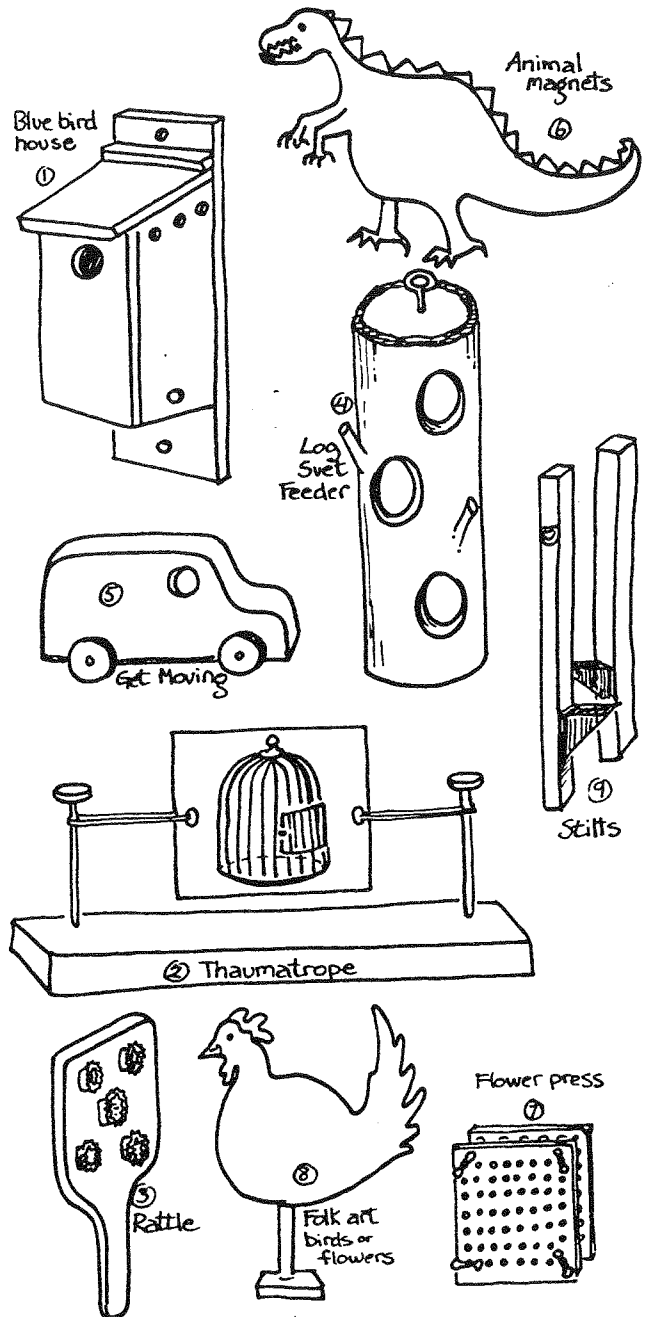
1. Participating in at least 2/3 of his/her own club meeting time;
2. Completing the project requirements to the satisfaction of the club leader(s);
3. Taking part in an Achievement Program.

## ***Specific Requirements***

1. Make the safety of yourself and others your number one concern.
2. Approach activities and projects with a willingness to learn.
3. Show proper respect for tools, both for reasons of safety and to keep tools in good shape.
4. Find someone who can act as a "home helper."
5. Have fun as you learn.

## Project Ideas

1. Help a feathered friend by building a bluebird house. You only need some pine lumber, a drill and a few nails.
2. Create your own magical moving pictures with a thaumatrope. (Sounds complex but it isn't.) This item is made from a small piece of wood, two long nails, two rubber bands, cardboard and some coloured markers.
3. If you have an interest in music, try a simple instrument like a castanet or rattle.
4. Build a simple bird feeder with a section of log, a drill, some dowelling and hardware.
5. Want to get moving? Make a car, bus or plane. Find a simple plan or use your own design.
6. Cut simple animal shapes out of thin board (e.g. dog, cat, cow, dinosaurs etc.) and glue on magnetic strips to turn them into fridge magnets.
7. Construct a flower press from two pieces of plywood, and four pairs of bolts and wing nuts.
8. Create folk art flowers or birds, by combining some cut out shapes in pine, some dowelling, and flat wooden bases. These can be painted or stained.
9. Make an old favourite – stilts.



PLEASE NOTE: The ideas for these projects are only suggestions. Many of them emphasize use, over beauty or finish. All of them can be altered to suit your own interests. You will find other good ideas for plans in books at your local library, or in your own imagination. Adding extra details, or choosing different materials or finishes, can increase or decrease the difficulty of a project. (Remember: If you change details like the type of joint, the length of a piece can change. Go over your plans with your Leader to make sure you have not overlooked these and other necessary changes.)

## *Meeting Schedule*

	DATE	TIME	PLACE
MEETING ONE			
MEETING TWO			
MEETING THREE			
MEETING FOUR			
MEETING FIVE			
MEETING SIX			
ACHIEVEMENT PROGRAM			

The 4-H Resource Development Committee of the Ontario 4-H Council reviews and evaluates 4-H resources. Comments and suggestions about 4-H manuals and guides are always welcome. They may be sent to the following address.

4-H Resource Development Committee  
c/o Guelph Agriculture Centre  
P.O. Box 1030  
Guelph, Ontario  
N1H 6N1

# GET INVOLVED

Be willing to let your name stand for an executive position. It is a rewarding and fun experience. Following your club's elections, complete this club executive chart.

## CLUB EXECUTIVE:

	<u>Name</u>	<u>Phone</u>
PRESIDENT	_____	_____
VICE-PRESIDENT	_____	_____
SECRETARY	_____	_____
TREASURER	_____	_____
PRESS REPORTER	_____	_____
OTHER	_____	_____

## CLUB MEMBERSHIP:

Members, Phone

Members, Phone

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Leaders, Phone

Leaders, Phone

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\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

OMAFRA Contact, Phone

4-H Association Contact, Phone

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\_\_\_\_\_  
\_\_\_\_\_

# Essential Resources

## ROLL CALL

As you introduce yourself, explain what interests prompted you to come to this 4-H project. What would you like to learn?

## *Essentials*

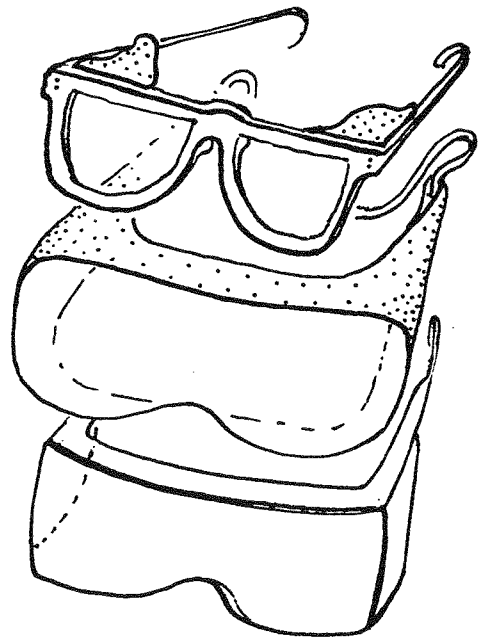
When it comes to woodworking, several things are required. You will need tools like saws, hammers and drills. You will also need a piece of material to work on, such as a piece of lumber or plywood. Often you need fasteners such as nails, screws, dowels or hinges. However, don't overlook other essentials. Here are the important ones.

## SAFETY

This aspect of woodworking cannot be stressed enough, particularly when working with electric tools. It is important that thoughts of safety precede any work. This is one instance when "better late than never" does not hold true. Working safely ensures you do not cause injury to yourself or others, or damage the tools you are using.



**GLASSES & GOGGLES:** Woodworking hands can have the occasional splinter or bandaged thumb without serious consequences. Eyes do not heal as easily! Make it a habit to wear protective glasses or goggles whenever you or anyone else is hammering, sawing or drilling. Safety glasses do a good job of protecting your eyes from direct contact from particles. Goggles do a better job of protecting eyes from pieces that could fly in on the side, but some people find them uncomfortable. (Use only safety goggles, not sports goggles – they are intended for different uses). Take care of your goggles or glasses too! They can be easily scratched, so keep them protected in a box when you are not using them.



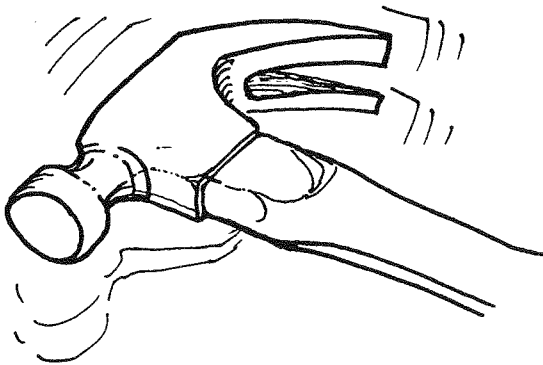
**NEAT & TIDY:** Always keep your work area neat. Keep tools where they will not fall or be damaged. Do not put sharp or pointed tools in your pocket, where they can hurt you.

**HAIR:** Tie back or cover long hair so that it does not get caught in equipment.



**OTHER "CATCHABLES":** Be cautious with anything that could catch. Loose clothing must be buttoned up and tucked in. Jewellery such as earrings, necklaces and rings should be removed.

**TOOLS:** Be sure your tools are safe to work with too! A loose hammer head can fly off and do serious damage. Check to see that all electric tools have safe cords, and are double insulated or properly grounded to protect against electrical shock. A drill bit must be properly tightened in the chuck. Protective guards on saws must be in place.



## HELP

There are many times when another head thinking, or another pair of hands holding will prove very valuable. You will find that two people working together can often do far more than you working on your own.

If you will be working on your project at home, think of someone to be a "home helper." Consider a parent, a guardian, a brother or sister, a friend, a neighbour, or a woodworker.

What can the home helper do? He or she can help you:

- Find materials and tools;
- Organize a place to work;
- Decide which project would suit you best;
- Understand what the instructions mean;
- Hold pieces when you are hammering, gluing or sawing;
- Judge your workmanship.

## WORKBENCH

You will need a spot to use for a workplace. Ask your parent, your guardian or your home helper for his/her ideas. The heart of a workplace is a work surface, or workbench.

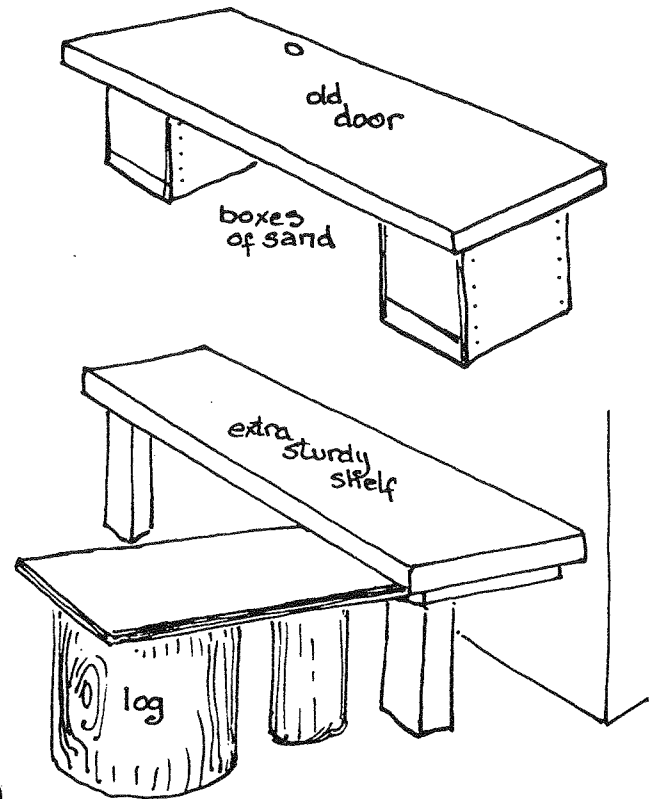
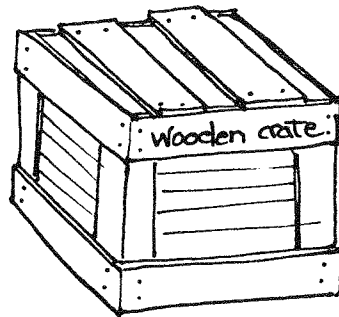
Like any other tool, a workbench has certain jobs it must perform well.

- It must hold work at a convenient working height. However, comfortable working heights vary with the task. Sawing is best done **below** the waist. Measuring and hammering are best done at waist level. A low workbench, such as a milk crate with a top, will let you saw comfortably (with your knee bracing the workpiece), but still works for hammering if you kneel down.
- It must be steady and secure, especially while you work. Weight helps here. You

can add weight by putting cement blocks or sandbags on the base, or the bottom shelf.

- It must have some way of allowing you to clamp pieces to its edges.
- It can not have nails or metal parts that will catch and dull saws and damage tools or your piece of wood.
- It might have to store tools and materials.
- It might have to be moveable.

Here are some suggestions for a simple workbench.



## BEFORE THE NEXT MEETING

- For Roll Call of the next meeting keep a wood diary for a day. Record every wooden item that you use or see. If certain items appear repeatedly, make note of how often. For instance, if there are wooden chairs at your kitchen table, and a wooden rocker in the living room, mark chairs a second time. Watch closely. You may not realize that some items are made from wood.
- Decide on a project you would like to make. Choose a plan that sounds

interesting and somewhat challenging. Avoid those which look too easy (they might be boring), or those which look too difficult (they could just be frustrating). The project should be something you can finish within the time you can give to it.

- Find a home helper.
- Organize a workplace at home.
- Bring the following if you have them: goggles or glasses, pencil, measuring tape or ruler (metric and imperial), carbon paper, a pattern to trace and a piece of wood to fit the pattern.



# Ready, Set, Go...

## ROLL CALL

Give your account of the wood items you used or saw in a day. How many were there in all?

## *Getting Organized*

### PLANNING

"Prior planning prevents poor performance." This saying is about the importance of being organized. Have you ever started a batch of cookies and at step five found you did not have the two eggs needed? Sound familiar? Then have all your plans, materials, tools and help ready **before** you roll up your sleeves.



### TOOLCHEST AND MATERIALS

During meetings and while working on your project, you will need a few tools and supplies. Here is a list to give you a good idea of what is required.

**TOOLS:** Measuring tape or ruler, carpentry (or other) square, hammer, saws – cross-cut, coping and perhaps a back saw, and clamps – "C", pipe and perhaps web.

**MATERIALS:** Wood for practice and for project (see plans for exact requirements), fasteners – nails, glue, hinges, screws, dowels and eye hooks, and perhaps some finishes such as oil finish, markers, paint, wood burner, varnish, etc.

**MISCELLANEOUS:** Certain projects require things like rubber bands, spools from thread, metal washers, marbles, push pins, cardboard, magnetic strips and wire. And don't forget another valuable resource – your library card!

## *Transferring A Pattern*

Sometimes a project includes a shape that is not square or rectangular. Usually a curving shape is transferred by tracing the pattern onto the wood using carbon paper.

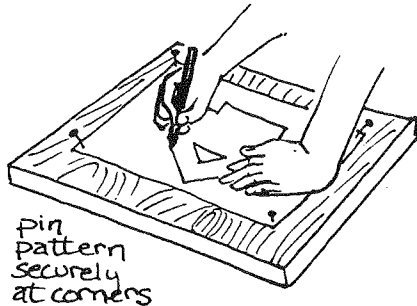
- AIM:**
- To transfer the lines of a pattern from a plan or book, onto a board.
- NEED:**
- A pattern of something you want to cut out.
  - A piece of wood large enough to fit the pattern.
  - A sheet of carbon paper.
  - A fairly dull pencil.
  - Push pins or thumb tacks, or masking tape.

- DO:
- Put the carbon paper on wood, ink side down.
  - Centre pattern on top.
  - Hold the pattern in place with pins or tacks.
  - Trace the outline and any interior lines.
  - Remove drawing and carbon paper **after** checking.

- CHECK:
- That **all** the lines are there before removing top two pins and drawing.
  - That lines are dark enough to see later, when you are cutting.
  - That lines are connected.

**CAUTION:**

- Do not damage books and patterns by using a sharp pencil. Photocopy the pattern or use tracing paper if necessary.



## M & Ms (Measuring and Marking)

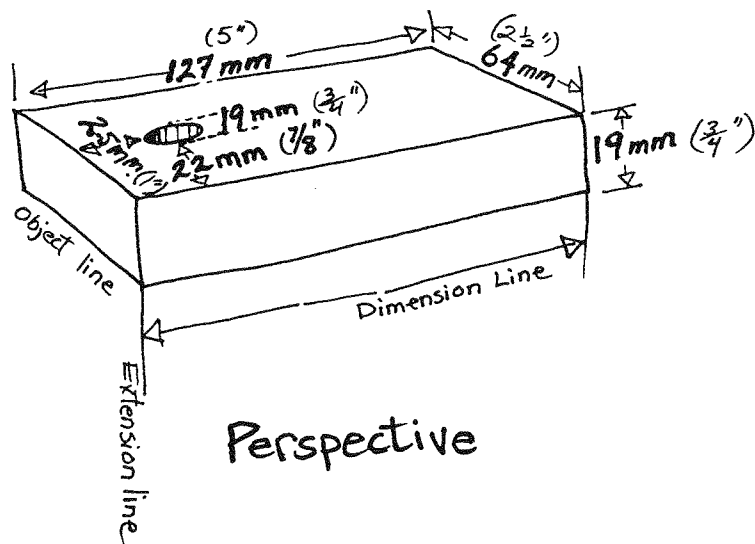
### DRAWINGS AND DIMENSIONS

When building something you will usually work with plans and drawings. From these you must be able to determine the measurements needed to cut, drill and fit. By figuring out these measurements, you will also know what material is needed to begin the project, if it is not listed in the plan.

### PERSPECTIVE DRAWINGS

In a perspective drawing the object looks just like it would in a photograph. **Object lines** outline the object and are the thickest. **Extension lines** extend from important corners or from the centre of holes, to slightly beyond the dimension lines. **Dimension lines** are narrower, and have arrows to show where the

measurements start and stop. These measurements give the thickness, width and length of pieces, and size and position of holes. Extension and dimension lines aren't part of the object.

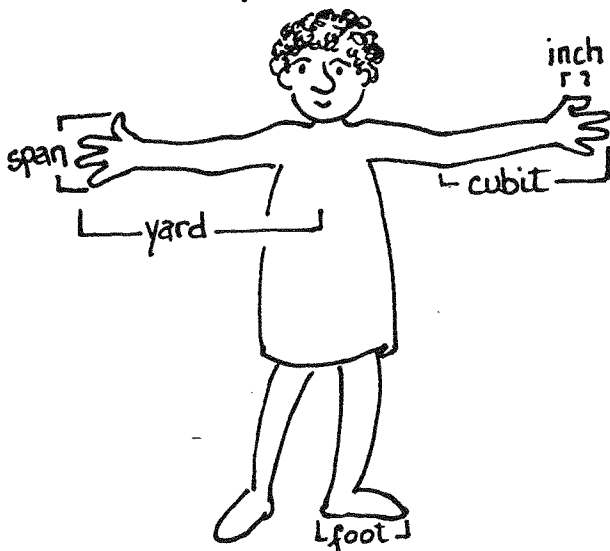


## "HANDY" MEASURES

Most of us take tape measures and rulers for granted. Centuries ago when the first objects were constructed, measuring tools were not commonly known. What could the builder use? One resource always lay at his/her finger tips!

It is no wonder that a length of imperial measure is known as a "foot." That is because the foot was a handy way of measuring material when the builder had no other tool. Eventually, simple body measures like the length of a foot, or a segment of a finger, or an outstretched arm became fixed and formed the imperial system.

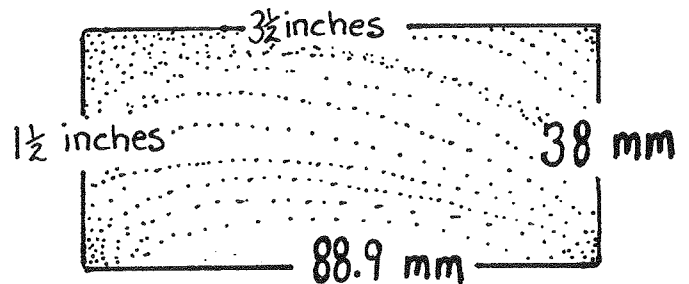
The body and its measures are a handy thing to remember – whether you are roughly sizing up material and forgot your tape measure, or you are thinking about designing furniture and tools for the human body.



## METRIC AND IMPERIAL MEASURES

It was only fairly recently that this country adopted the metric measuring system. For over a century, Canadians have used imperial measures. While many industries switched to the metric system easily and quickly, the lumber industry has not.

Look at the actual measurements for the 2 x 4" (50 x 100mm), the standard board for construction throughout North America.



The lumber industry can use the same size board, with the awkward metric measurements, or it can change its sizes (and the equipment to do so) to a simpler metric measurement. Changing the size would also result in great waste with certain materials now sized to fit the current standard, i.e. insulation, drywall sheets, panelling etc. Because neither of these options are very good ones, little has changed in the lumber industry.

Since most members are familiar with only metric, information is provided in both metric and imperial measurements. When following instructions, please use the same system of measure once you begin since the conversions are not always exact.

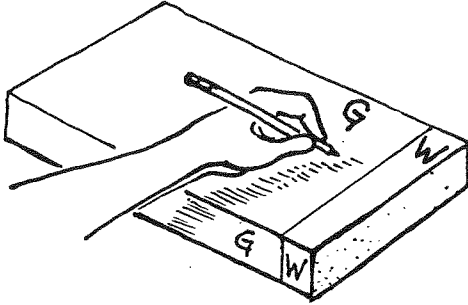
## MEASURING HINTS

When you are ready to measure and mark, here are some helpful tips to keep in mind.

- Be sure to measure twice, and cut once. Finding you have the wrong measurement afterwards, can mean pieces will not fit properly, and this often wastes material.
- When measuring long dimensions have a tape or ruler that is longer. Moving a small ruler several times can result in a big

mistake from errors that add up as you go along.

- Get into a habit of marking the good and waste side of a cut. It is important that the saw cut (**kerf**) is on the **waste** side of the line. When building a frame or box, the width of this kerf can mean the difference between a poor fit and a good one.



- Do not mark out several measurements on one board at the same time. You would have to allow for the thickness of the kerf and this is difficult.

---

## **BEFORE THE NEXT MEETING**

---

- For the Roll Call of the next meeting, bring in one of your favourite small wooden items. This might be a spoon, jewellery box, bowl, etc. Think about why you have chosen it.
- If you're not feeling comfortable about imperial measurements, try measuring some of the items you noted in your wood diary. Or measure several kinds of the same item, i.e. chairs or tables. If so, how similar are they? In all dimensions?
- Tools and Materials: If you have them, bring in goggles or glasses, square (any kind), pencil, crosscut saw, coping saw, backsaw, rip saw, wood with pattern traced on it, C-clamps and some pieces of wood to work on (practice pieces and/or pieces for your project).

# Hip To Be Square

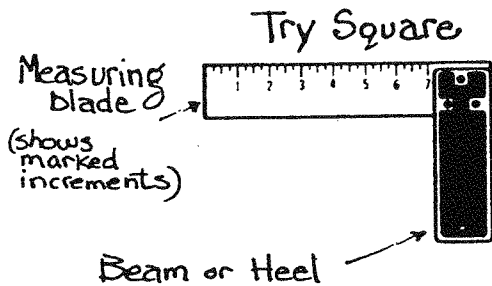
## ROLL CALL

Show the wooden item you selected and brought. Explain why you like it.

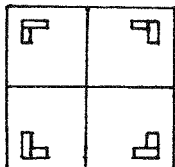
## M & Ms

## SQUARES

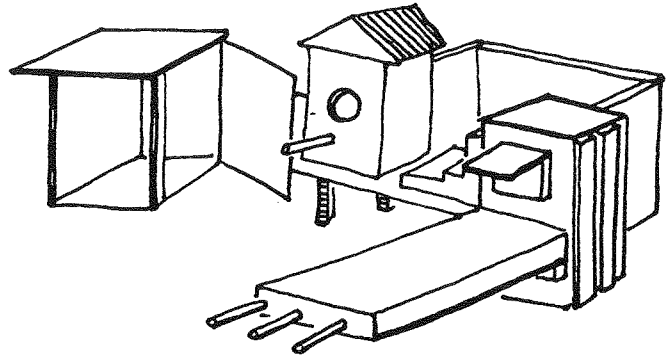
Tapes, rulers and squares can all used for measuring and marking wood. The main function of squares however, is to mark or check right angles. There are several types of squares. Each has a slightly different use.



The words "squares" and "quarter" are both from the Latin word meaning "one of four." This is because you can put four together and create a whole circle, or a box. Because of its simplicity, or "rightness," square angles are the basis for most carpentry and cabinetry work.



Square angles can be put together in endless ways.



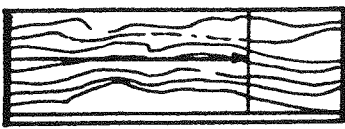
## USING THE SQUARE

- AIM:
- To learn to use the square.
- NEED:
- A steel square, sharp pencil and a piece of board with one straight edge.
- DO:
- Measure out and make a mark on the face of the board where you would like to draw a line.
  - Hold the heavy side of the square, the **beam**, against the flat edge of the board, keeping the blade as flat as possible on the face of the board.
  - Position the square so that you will draw through the mark.
  - Draw your pencil along the blade, passing through your mark.

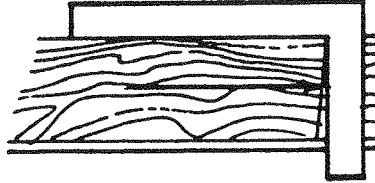
- CHECK:**
- Lift off the square and check for squareness. Flip the square, from left to right, so that the square lies along the same edge of the board, but on the other side of the line you just drew. Or lie the square on the opposite long edge. If the line is square, the blade will still line up with the whole line.

- HINTS:**
- You cannot make a square cut without a square line.
  - To guide very accurate cuts, use the square to continue the line down both sides of the board, and onto the bottom side.
  - Keep the square where it will not get bumped, dropped, or stepped on and lose its "squareness."

Straight square line



Off-square line



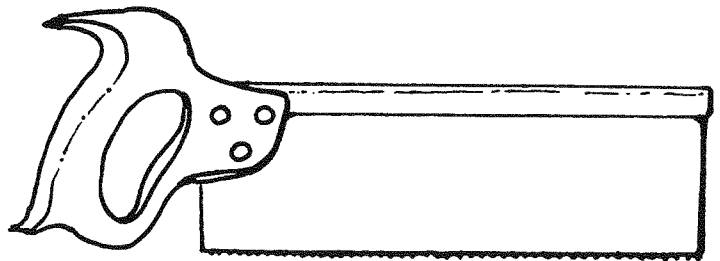
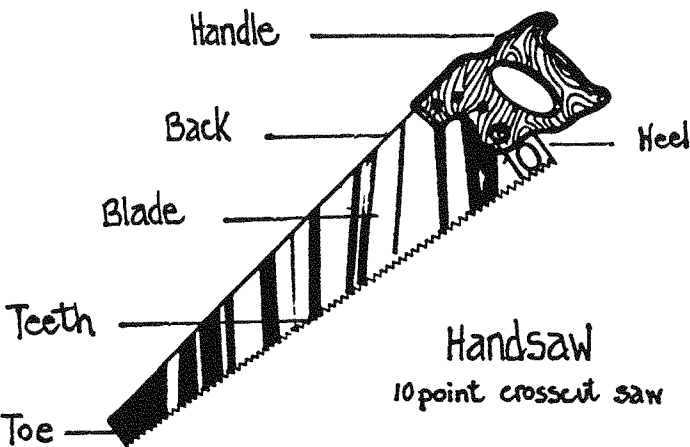
### Cutting Comments

#### TYPES OF SAWS

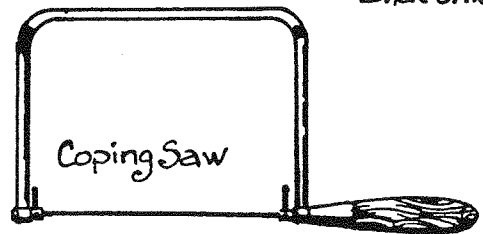
Just about every woodworking project begins with sawing. There is great variety in saws, for many different purposes.

The most common saw is called a **handsaw**. There are two types. A **crosscut saw** – the most common – has about eight teeth per 25 mm (inch), and is used to cut across the grain. A **rip saw** has half as many teeth, and is used when cutting along the grain of the wood. Cutting lumber along its length is a tough job. To avoid using a rip saw, buy wood of the right width to begin with, or use a table saw.

A **backsaw** has a metal strip along the blade's top edge. This stiffens the blade, preventing buckling or twisting. A backsaw is often used with a mitre box for making exact forty five or ninety degree angle cuts.



BACK SAW



Coping Saw

For curved cuts a type of **frame saw** is usually used. These saws have fine blades held under tension by wooden or metal frames. A **coping saw** is the most common type. For very deep cuts, the wider **fret saw** is very valuable.

## SAW TIPS

Even though they do hard work, saws are delicate tools. Be sure the blade is clean and straight with sharp teeth. Show respect for your saw – keep it out of harm's way.

## SAW SAFETY

Like other tools, saws must be handled in a safe manner.

- Keep guards in place until you use the saw.

- Keep the teeth of the saw pointing downwards.
- Do not wave the saw around.
- Do not point them at people, or lay the cutting edge against skin or clothing.
- Do not run with the saw.
- Do not bend the blade back sharply (you might kink or snap the blade, or hurt someone when you let it go).

## IN THE GROOVE: USING A CROSSCUT SAW

**AIM:** • To learn to use a crosscut saw.

**NEED:** • A board with marked square line, C-clamp(s), vice (or your knee) and a crosscut saw.

**DO:** • Secure marked board on a work surface, pencilled side up, using clamp(s), vice or your knee. Be sure the marked cut line is **just beyond**, the edge of the work surface and the bar of the clamp.

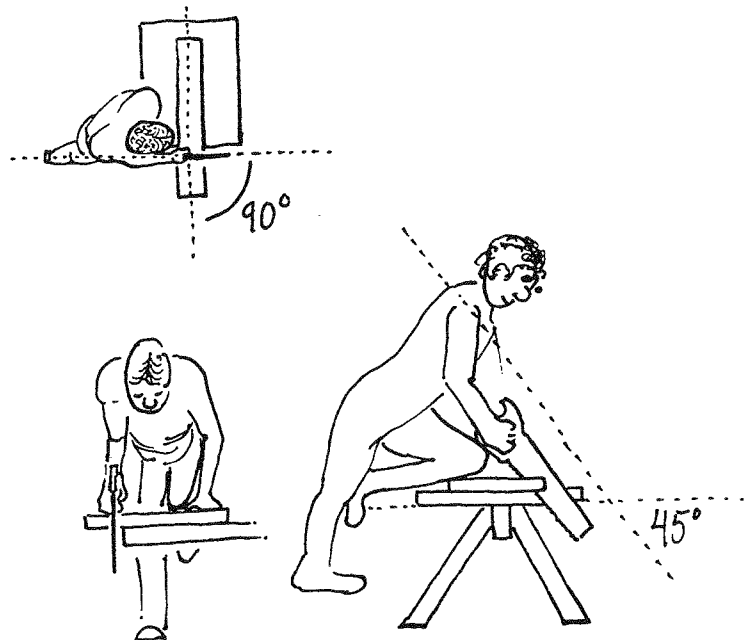
- To start a cut, place the saw on the waste side of the line and lightly draw the saw towards you, about three times, to create a straight, guiding notch. The thumb of your free hand can help guide the saw at this stage.

- Place your free hand on the board, to help hold it in place.

- Imagine the line on the board extends across the room. Line up the saw, your forearm, shoulder and eye with this mark.

- Saw with long, smooth, straight strokes, pushing gently on the downward stroke. (Japanese saws work on the *pull* not the *push* stroke.)

- Just before the cut is finished, bring your free hand up and over the saw to hold the dangling piece and prevent it from breaking off.



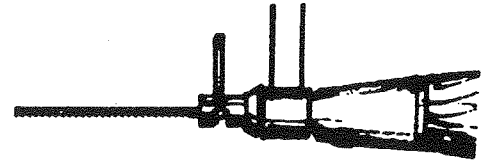
- HINTS:
- Be sure the saw does not run into the work surface or the clamps.
  - Have the board properly secured and supported close to the cut.
  - Be sure the wood is "cut-able." Knots, hardwood, particle board and wet wood are very difficult to saw.
  - Keeping the saw **straight**, "in the groove," is the biggest secret to sawing. That and lots of practice!

### COPING WITH A SAW

A coping saw is used to make fine, curving cuts in fairly thin wood. The blade is very fine, and extra caution is needed to prevent bending or breaking it. The saw works on the downstroke.

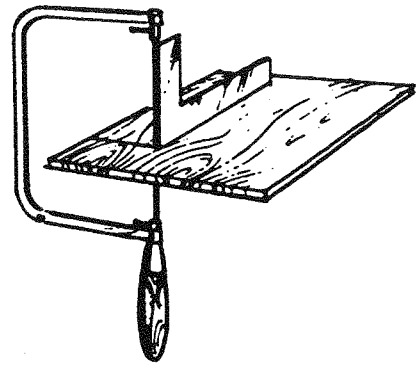
- AIM:
- To learn to use a coping saw to make a curving cut.
- NEED:
- A coping saw, a board with a pattern traced on it, C-clamp(s) or vice.
- DO:
- Secure your workpiece using clamp(s) or vice. Be sure the saw will not run into the edge of the work surface. You may have to reposition the piece a few times.
  - Begin with a few slow strokes, sawing on the outside of the pattern's line. Use reasonable pressure on the downstroke.
  - When you need to turn, do so while slowly moving the saw up and down.

- HINTS:
- Make sure the blade's teeth are pointing downwards, and the blade is lined up and properly tightened.



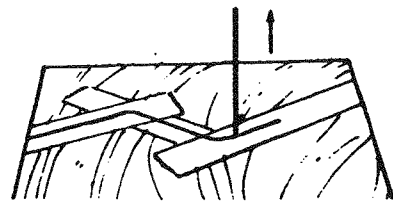
Teeth pointing toward the handle

- Use a square to see if you are holding the saw at a right angle to the work piece.



Saw square with surface

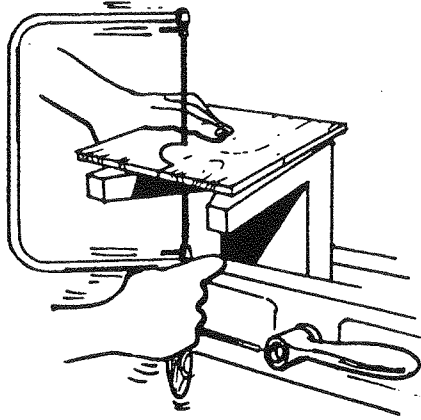
- For a smooth bottom edge, lay masking tape along the cutting path before sawing.



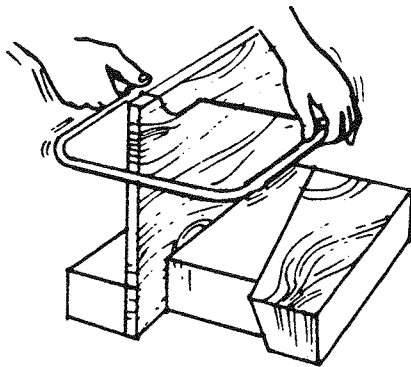
Place tape on side where teeth points come out.



- Cutting with a coping saw is most easily done working in a vertical motion. If necessary, you can saw using it in a horizontal position.



Coping saw in upright position



Coping saw in horizontal position

- When necessary, the blade can be turned around so you can saw on the backstroke, rather than the forestroke.

It takes a lot of practice to be good at any skill. Look for smooth, squared cuts. Take note of your improvement and be proud.

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## BEFORE THE NEXT MEETING

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- For the Roll Call of the next meeting, look again at the objects in your wood diary or around your home. This time make note of the shapes of the wood in these pieces. Describe in words, illustrate with drawings, or bring in samples of four or five different shapes where the wood's original square or rectangular shape has been altered. Think about how these shapes might have been made, or why they are the shape they are.
- Tools and Materials: If you have them, bring in safety glasses or goggles, a hammer, nails (a variety of types and lengths), an electric drill and bits and pieces for your project or for practice to nail or drill.

# Putting It Together I

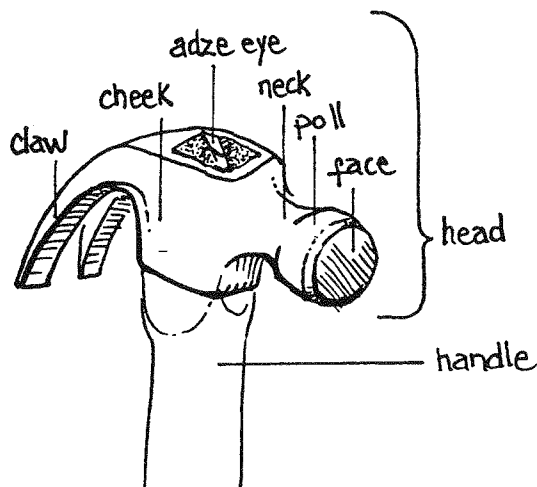
## ROLL CALL

Illustrate, describe or show the shapes you found where wood's original square or rectangular form has been altered to create new shapes. Do you have ideas of how they were formed? (Consider options such as: being cut in a curve or an angle, turned into a round shape, carved, shaped into a profile with a spinning cutter.)

## Joining Wood

### THE HAMMER

The hammer is one of the most common tools in woodworking. A simple tool, it takes only confidence and accuracy to master. Because it is designed to deliver a force, treat the hammer with respect.



### HAMMER SAFETY

- Before using a hammer, inspect it to see if the head is secure. If it is not, have it repaired before using.

- Be sure to wear goggles. Small chips of metal or wood can seriously injure eyes.
- Tie up or cover long hair and take off earrings, so they do not get caught in a passing hammer's claw.

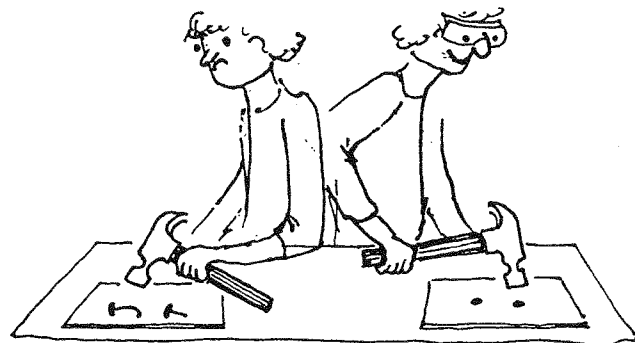


### HANDLING THE HAMMER

Being good at hammering depends on two things: the grip and the swing.

### THE GRIP

At first, you might try to use the hammer with your hand near the head. This makes it easy to hit a nail. However, the hammer can not strike very hard. To deliver a straight, powerful push, the hammer must be held near the end of its handle. Give it a few tries this way. You will soon see the difference, and be able to manage it.



## THE SWING

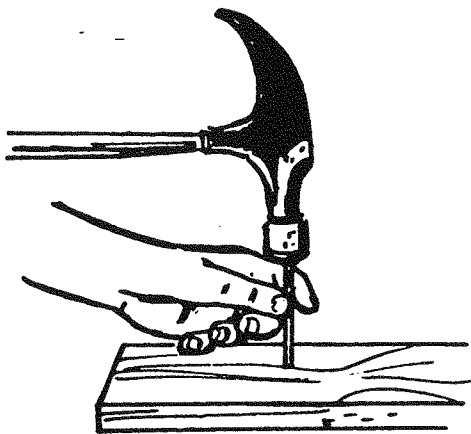
The real skill in hammering is in the swing. To be effective at hammering, you must use your whole arm, rather than just your hand.

- A swing from the wrist usually has good aim, but little power. This is great for starting nails.
- A swing from the elbow down produces a smooth stroke, and much more push. This is good for the fine nailing done in finish cabinetry.
- A swing from the muscle of the whole arm moves the hammer head and nail fast and far. This is best for large nails, like those used in construction carpentry.

## HAMMER HINTS

### STARTING NAILS

- The nail is held between the thumb and the first finger.
- Tap it into the wood with short wrist swings.
- Let go of it when it can stand on its own without wiggling.

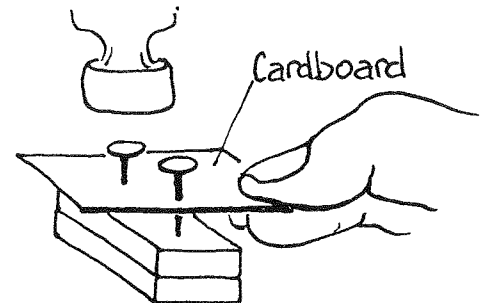


Grasp near the head.

## STARTING SMALL NAILS

Small nails are sometimes difficult to hold. Here is a trick to help.

- Push a small nail through one end of a piece of cardboard.
- Hold the other end of the cardboard, with the nail in place on the workpiece.
- Tap nail gently into place.
- Pull the cardboard out, when the nail is well started.



## DRIVING NAILS

When you are driving a nail your skill comes into play. So too does the work surface. You **must** have the piece(s) on a solid table or floor. It is extremely hard to hammer a bouncing board!

- With your hand down near the end of the handle, swing at the nail.
- Concentrate on your aim and be sure to **hit the nail squarely on the head.**
- Continue driving the nail until its head is **flush (level)** with the surface of the wood.

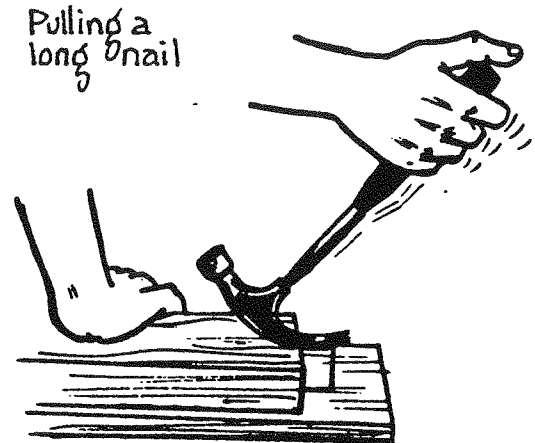


## HAMMERING INTO HARDWOODS

Hammering nails into hardwoods is not as easy as it is with softwoods. The harder wood often makes starting and driving a nail almost impossible. To get around this difficulty try the following.

- Line up the pieces to be nailed, and clamp them together.
- Mark the locations of the nails with a scratch awl.
- After selecting the nails, find a drill bit slightly smaller in size.
- Following the directions for using an electric drill (see page 21), drill a **pilot** or starter hole through the two pieces, to the approx. length of the nail.
- Then nail as you have done above.

- Slide the claw under the nail's head until it is firmly grasped.
- Pull back on the handle to remove the nail.
- When there is enough space, put a small block of wood between the hammer's head and the work piece to prevent denting and to make the pull straighter and easier.



## PULLING NAILS OUT

Most woodworking hammers have a claw opposite the face for removing nails. Here's how it's done.

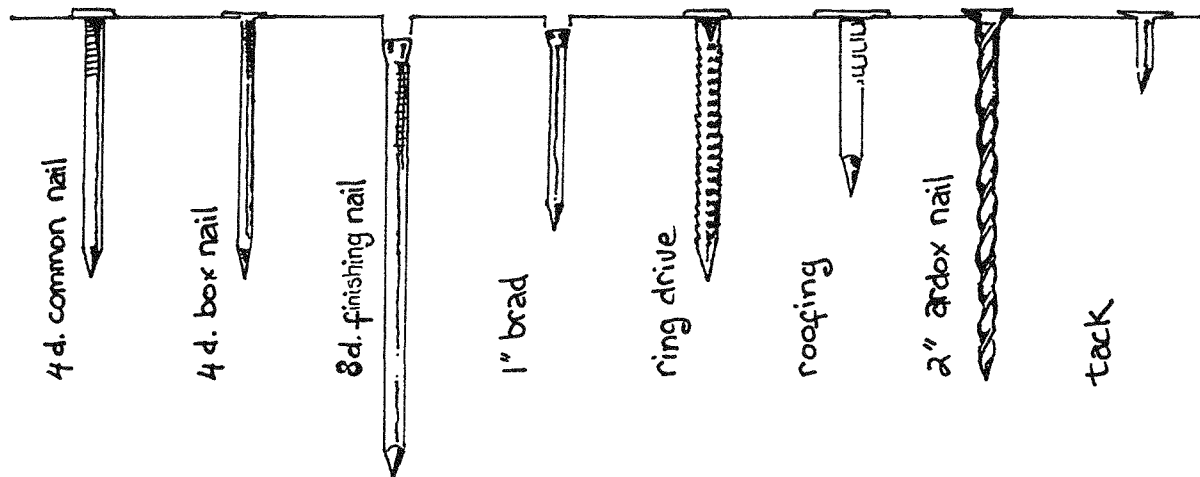
### CAUTION:

- Be careful of nails that refuse to budge. You could break a hammer handle, and go flying!

## Nails

### TYPES OF NAILS

As with other tools and materials, there are specific nails for most jobs.



**Tacks** are short, thick nails with large heads and very sharp points. They are used to attach fabric or leather to wood.

**Finishing nails** are fine nails with fine heads. These are intended to "disappear" into the wood. The heads have a slight dimple to help hold a **nailset**. (This small punch-like tool is used with a hammer, to finish driving nails flush, or lower and to prevent the hammer from denting the wood.)

**Brads** are short finishing nails.

**Common nails** are heavier than finishing nails. They have wide flat heads. As their name suggests, they are a general purpose nail used for most construction.

**Roofing nails** are quite short and thick, with very wide, flat heads. To do their job well, they are specially treated, in this case **galvanized**(see below).

**Flooring nails** are ringed or ridged in a unique pattern. This is to prevent them from pulling out.

Nails like finishing and common nails can be **spiralled**, for better holding power. These are called **ardox**. Nails can also be specially coated. Tacks can be **blued**. **Galvanizing**, a hot dip of zinc, prevents nails from rusting in damp situations. You will find all roofing nails, some common nails, and occasionally some finishing nails galvanized. Sometimes nails are made from special metals. Tacks are sometimes brass, for a decorative effect.

## CHOOSING THE RIGHT NAIL

### TYPE

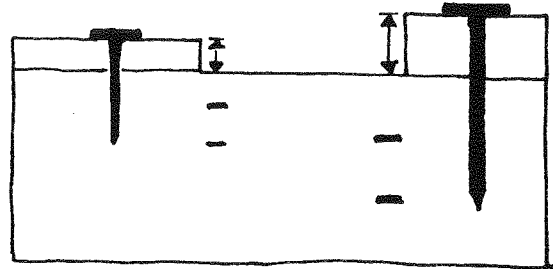
Begin by selecting the right kind of nail for the job. Check the descriptions above. Most of the time you use finishing nails for fine work,

and common nails for most other work. For practice you can use anything.

### SIZE

Choosing the right length of nail is the next step. Here are some guidelines.

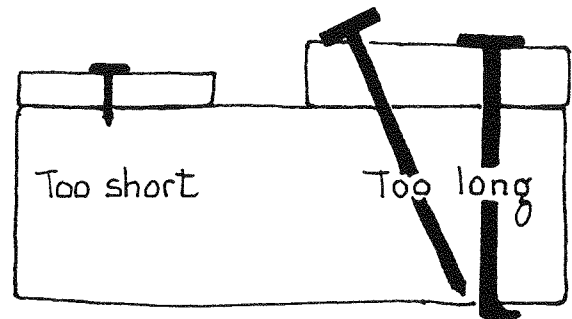
- When nailing thinner boards to thicker boards, the nails should be twice the thickness of the thin board. (Always nail through the thin board first.)
- When nailing boards of the same size, the nails should **almost** go through.



## NAIL PROBLEMS

**TOO SHORT:** When nails are too short, they just can not hold. Using more does not usually help. Using glue can make a difference.

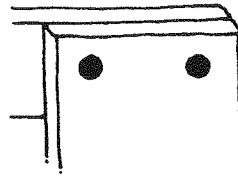
**TOO LONG:** Nails which are too long for the job push their points out through the far side. Because longer nails are also bigger (in diameter), they can cause splitting.



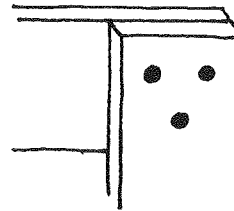
## SPLIT ENDS

There are ways to avoid splitting wood when you are nailing. Here are some tips.

- Use the right size of nail.
- Flatten the nail's point (it does work).
- Position nails back from the end or edge of a board, and away from knots.
- Offset the placement of the nails, so they are not lined up along the same grain.
- Pre-drill pilot holes in hardwood.
- Nail through the thinner board, into the thicker board.



Keep nails from edge



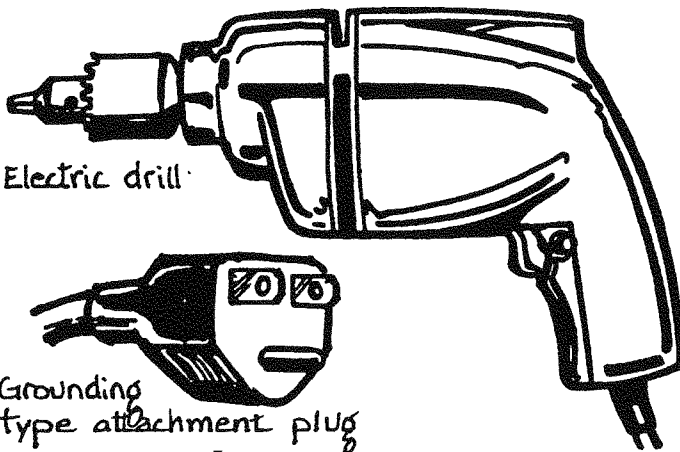
Offset placement of nails



Flatten point of nail

## The Electric Drill

Although there are manual drills (the egg-beater and the brace are two styles), the electric drill is the most common. The method used for any of these is much the same. Some extra precautions apply to the use of any electric tool.



Electric drill

Grounding type attachment plug

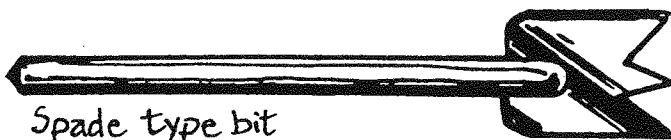
### WHY USE A DRILL

A drill will enable you to make holes, usually about 25mm (1") or less in diameter. These may:

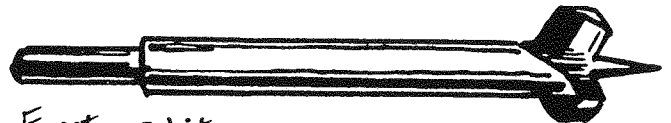
- Be part of the design itself, i.e. a pattern of holes in the wooden seat of a chair
- Hold fasteners such as dowels, and screws
- Be used to thread saw blades through to cut interior shapes.



Twist drill



Spade type bit



Forstner bit



Twist drill with turned down shank



Brad point drill bit

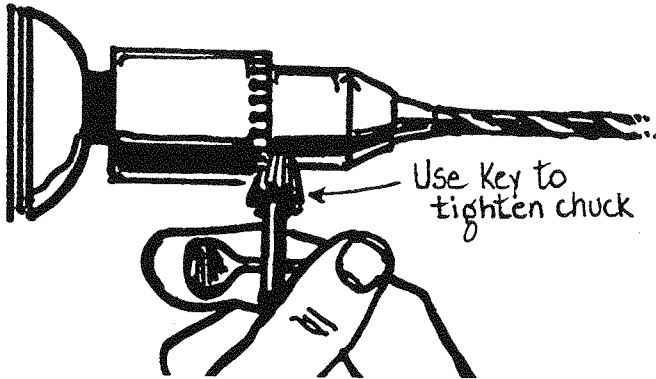
## DRILL SAFETY

REMEMBER when a tool is electric:

- Double check that the drill is double insulated or has a grounded (3 prong) plug
- Check to see the cord and plug are in good condition
- Disconnect the plug when changing bits.

Because the bit and chuck of this tool spin:

- Check that the chuck is tightened securely around the bit, and that the key is removed



- Make sure your workpiece is securely clamped so it does not spin around or fly off and hurt you
- Keep hands, hair and anything that could catch, away from the chuck and bit.

### CAUTION:

- Do not forget your goggles.

## DRILLING HOLES

AIM: • To learn how to use an electric drill for making holes.

NEED: • A scratch awl, or nail and hammer.  
• A pencil and square or ruler.

- C-clamp or vice.
- Drill and bits, 5 to 10mm (1/4 to 1/2").
- Goggles.
- Pieces of scrap lumber.

DO:

- Mark the position of the holes with a square. Keep these 38mm (1½") from the edge.
- Make a small centring dent with the awl.
- With a piece of scrap wood underneath, clamp the board to the work surface.
- Position drill squarely over mark, place the bit in the dent and depress the drill's trigger.
- Apply firm, steady pressure as you drill.
- Pull the bit out every cm (½") to clear cuttings.
- Try to keep the drill bit square to the wood .
- Continue until you feel the slight jolt of the bit going through the board.

- CHECK: • For the squareness of the hole.  
• For rough edges on the bottom of the hole. Reduce this problem by clamping a scrap piece of wood underneath the workpiece.

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## BEFORE THE NEXT MEETING

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- For the Roll Call of the next meeting think about how the demand for wood affected how this country was settled.
- Tools and Materials: If you have them, bring goggles or glasses, carpenter's glue, C-clamps, pipe clamps, scratch awl, square, pencil, electric drill and bits, screws (various sizes, about 35-44mm long, 1 3/8 to 1 3/4") and scrap or project pieces to join together.

# Putting It Together II

## ROLL CALL

Wood was one of the resources that attracted explorers and settlers to Canada. How was wood used, and what role did it play in the settling of this country?

## *Wood In Canada's History*

It was in wooden sailing ships that the Europeans first arrived on Canada's shore. Timber for ships like those they came in was one of the very reasons for their arrival. Timber for masts, keels and planking meant power and wealth. Canada filled these needs well. Lumber for all sorts of other uses was soon filling ships' holds.

Canada's trees provided rich resources for Europe. Thousands of trees were burned to produce potash. This fertilizer was then shipped to the Old World to improve its soils.

Exploration and settlement of this country developed along three types of transportation routes. The voyageurs were in search of beaver pelts. They travelled the waterways in wooden canoes. The beaver, the source of the most desirable fur, was usually found near their preferred food – poplar trees.



Later, settlers journeyed over rough roads (often corduroy ones built of logs), and over wooden bridges in wooden wagons. Their first homes were of logs, and much of their furniture was made from local lumber. The boiled sap of the maple and birch trees provided them with their sweetener. Many other trees and plants of the forest furnished valuable food, particularly nuts, and medicines too.



Before settling, many newcomers such as the Pennsylvania Dutch, journeyed until they found black walnut trees. These were used as indicators for the deep, rich soil they wanted. Their settlement patterns can still be used to trace the location of virgin stands of black walnut.

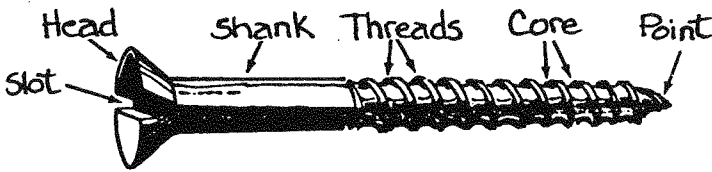
When transportation took an organized turn, railroads began to crisscross the country. These relied heavily on a massive amount of timber for ties and coaches, and occasionally for fuel. Great quantities of timber were also used for the structural supports needed in mines, many of which produced the iron ore used in the rails.



Just as it was in the past, Canada's industries and development remain closely connected to wood. We are an important source of lumber for construction and fine furniture. We are an international supplier of wood for pulp and paper production. Maple syrup also brings in valuable income for its producers.

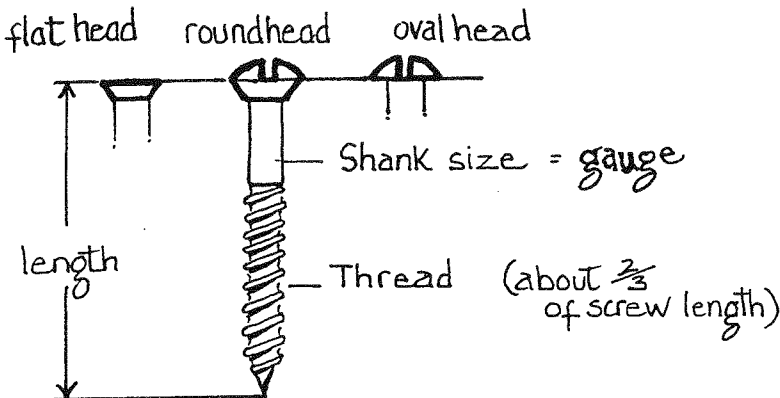
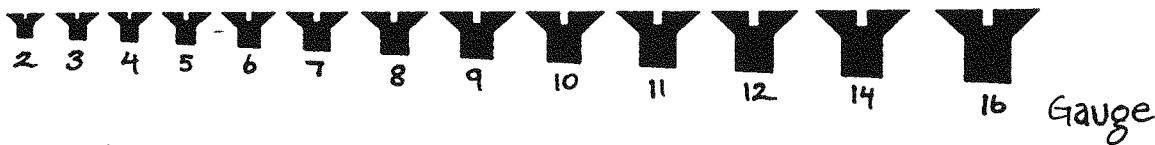
### Joining Wood With Screws

Being a wedge on an angle, this fastener is one of the strongest machines man has ever made. They have greater power than nails to pull things together. They resist being pulled out and work better than nails when a pulling force is exerted. Used in combination with glue a very strong joint is created. Used on their own, removal is easy so large items like tables can be taken apart for storage or moving.



### TYPES OF SCREWS

A screw's head is described by the pattern the screwdriver fits into, or by the head's shape in cross-section (looking at it sideways).

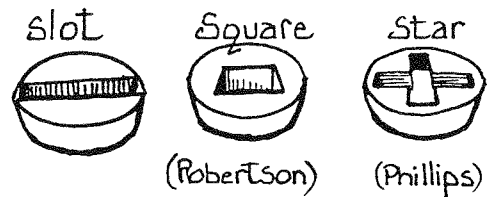


### DRIVER PATTERN

There are three main types of driver patterns used on the heads of screws: slotted, Phillips and Robertson. The slotted head is the most common, having a single flat slot across the head of the screw. One drawback with this pattern is that the driver can slid out and damage the wood. The Phillips has a deep "cross" pattern. The Robertson head has a recessed square shape. Both the Phillips and the Robertson patterns are more efficient and make the jobs of starting and turning the screw easier. All of these patterns come in different sizes, and the drivers must fit properly to work well.

### SHAPE OF HEADS

If you look at a screw from the side you will see the head can have different profiles. They can be three shapes: oval, round or flat. The ovalhead screw has a slightly curved head, as well as a taper below the head, so that it can be countersunk. When countersunk, the tapered part of the head is driven into the wood. As you can guess, the roundhead screw has quite a rounded head. When this screw is tightened down properly its head still sits on the surface of the wood. The flathead screw is flat, with a taper below, and it too is countersunk, so the head of the screw sits flush, or level with the wood's surface.



## CHOOSING THE RIGHT SCREW

### SIZE AND LENGTH

The size of the screw's **gauge diameter** is indicated by a **number**. The gauge diameter is the size of the wider **shank** part of the screw. The numbers go from 0 to #24. The lower the number, the smaller the diameter. When choosing a screw, do not use one any larger than necessary, so you can avoid problems with splitting. The most commonly used sizes are #4, 6, 8 and 10.

The length of screws available varies somewhat with the number sizes. Choose a length which leaves just over half of the screw going into the second piece of wood. (As with nailing, join the thinner piece to the thicker piece.) Be sure to have the screw length about 3.2mm (1/8") less than the total thickness of the two pieces.

### FINISH AND MATERIAL

Most screws are plated with zinc. This makes them suitable for indoor or outdoor use. Unplated screws are fine for indoor use where humidity or the acids in the wood itself are not a problem.

Most screws are made from steel. There are also screws made from brass or bronze for special uses, e.g. decorative effect or superior resistance to corrosion. The rule of thumb is to always choose a screw made of material which is harder than what you are screwing into.

## TYPE OF HEAD

While all three types of driver pattern heads are available, many woodworkers prefer the Robertson style. These provide good grip with little chance for slipping. Choose a flathead screw when the screw should be flush with the surface.

## WORKING WITH SCREWS

**AIM:**

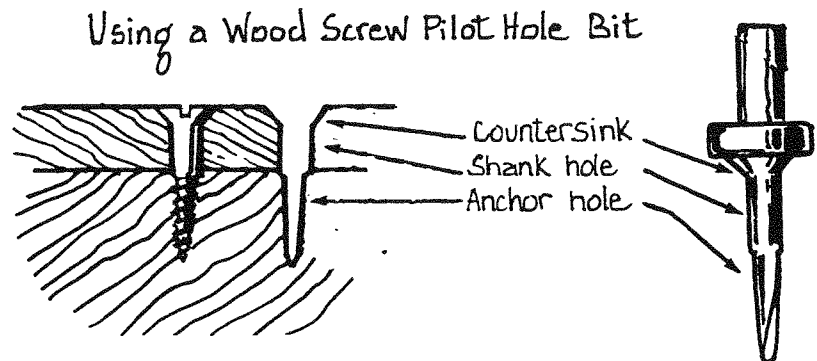
- To join two boards with two wood screws.

**NEED:**

- Two pieces of wood, 19 x 89 x 150mm (3/4 x 3 1/2 x 6").
- Two 32mm (1 1/4") # 8 flathead woodscrews.
- Screwdriver to fit the screw heads.
- C-clamp.
- Square and pencil.
- Scratch awl (or nail and hammer).
- Drill and wood screw pilot hole bit for 32mm # 8 screw.

**DO:**

- Use the square to mark a line 25mm (1") in from the end of one board.
- Mark the centre holes for two screws, roughly centring them across the width of the board.
- Clamp the blocks together, as you want them joined.
- With the pilot bit properly in place and tightened, drill the two holes.
- Carefully drive the screws in place with the screwdriver.

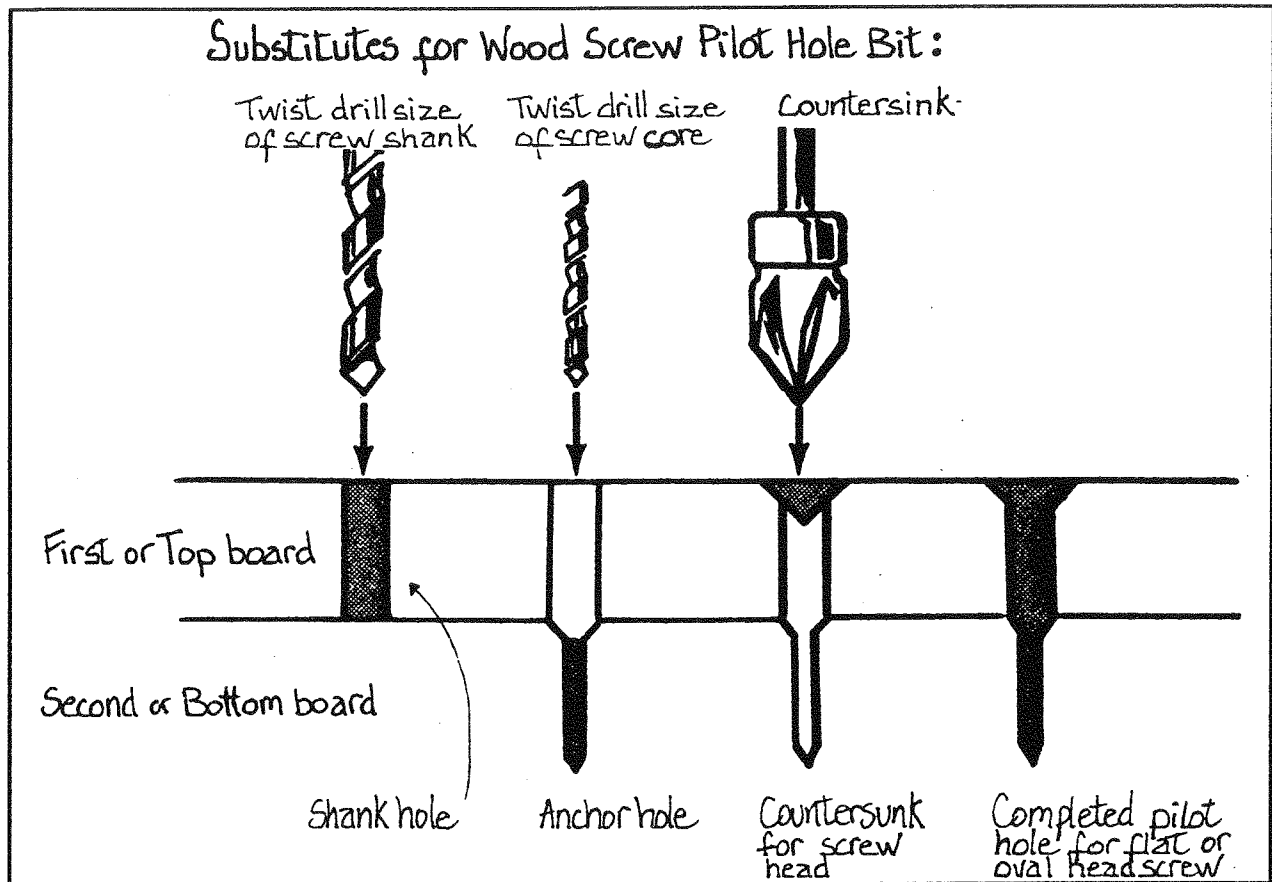


**CAUTION:**

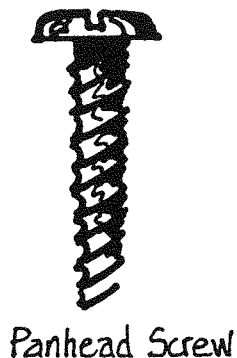
- When checking for flushness, do so by **looking** not feeling, so you do not cut a finger on a torn metal edge.

**NO WOOD SCREW PILOT HOLE BIT?**

If you do not have one of these bits, you can use three separate bits to create the same type of hole. (The following illustration shows how this is done). This time you must drill an **anchor hole** for the root diameter (the narrow part) of the thread, a larger one for the **shank** and a third tapered hole for the **countersink**.



**HINTS ON USING SCREWS**



- Centre mark holes, particularly those that have to be precisely located, using an awl or nail and hammer.
- Use soap or a little wax on the threads of the screw if it is difficult to turn in.
- When joining metal or plastic to wood, use a **panhead** screw. These have threads all the way up their length, and a flat head that sits slightly above the surface.

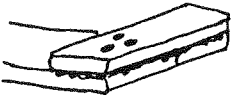
## Joining Wood With Glue

Through the centuries, glue has been made from a wide range of ingredients. These have included the blood, hide, horns and hooves of animals, bee's wax, fish, flour, tree pitches (resins), soybeans, egg whites and even cheese curds! Most of today's glues are derived from types of plastics called polymers. They are often the most "modern" tool you will use.

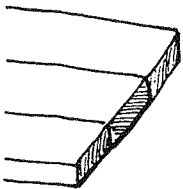
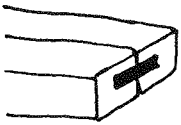
### WHY GLUE

There are several different reasons why glue is used.

#### Strength:

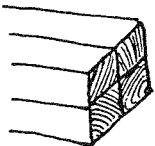


- Helps hold members of a joint together
- Holds fasteners like dowels and splines in place
- Produces structural members with greater strength, and often less weight.



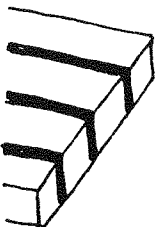
#### Size:

- Makes wider boards, for shelving, tables tops etc.
- Makes large blocks for turning.



#### Visual Effect:

- Produces certain patterns with figure (using veneer or special layout of boards), or with colour (combining different woods in one piece).



### TYPES OF GLUE

Glues differ considerably in the uses they are put to, and the care with which they are used. The glues listed below are easy to obtain and easy to use. While they are good for all-purpose use, neither of them can take extremes in temperature or moist, damp conditions. So, for example you wouldn't use them for putting together a birdhouse or an exterior sign.

#### White Glue (polyvinyl resin emulsion):

- Comes ready-mixed and is easy to use.
- Dries quickly, in about an hour.
- Readily available and cheap.
- Use at temperatures of 15 C (60 F).
- Even when dry it has low resistance to moisture (not a choice for exterior use), and temperatures of over 74 C (165 F).
- Glue line will stretch (therefore not usable for gluing wood together for turning).

#### Carpenter's or Yellow Glue (aliphatic resin):

- Very similar to white glue.
- A little more resistant to heat and weather.
- Sometimes rated for strength.

### HOW GLUE WORKS

Glue is absorbed by both surfaces it is applied to. As it dries, a bond is created between itself and the shallow layers of wood that absorbed it. When these surfaces are held closely together as the glue dries, the two become bonded.

### GLUING PROCEDURE

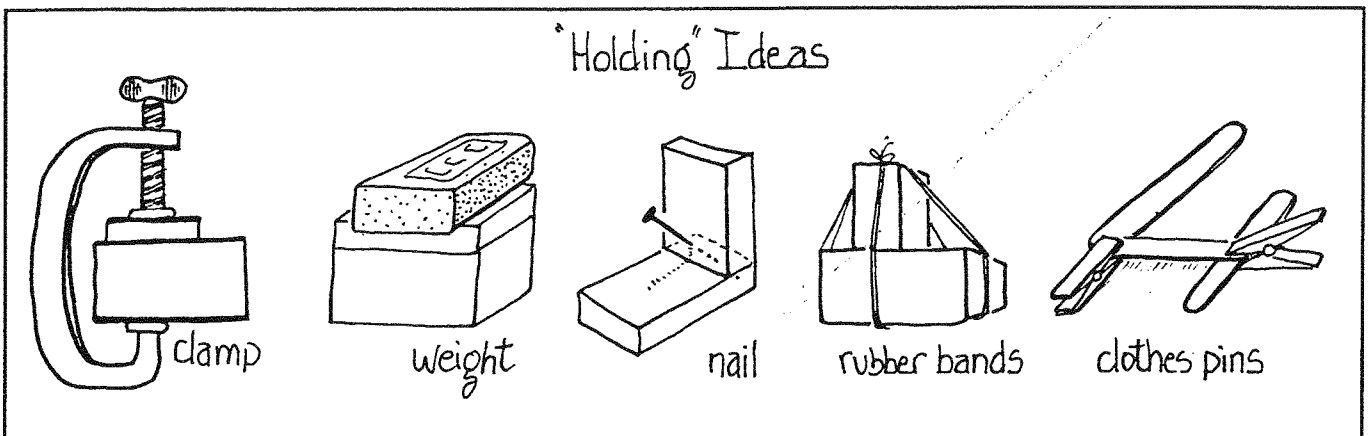
1. To make glue work well, the pieces must be properly prepared.
  - Wood must be at the proper moisture content (6 to 8% for interior use and 12 to 15% for exterior use).

- Pieces must fit **snugly**, whether planed edges or cut members of a joint.
  - Surfaces to be glued must be really clean – absolutely free of dust, sweat or grease.
2. There must also be a means of holding the pieces together tightly, but without excess pressure.
- Use clamps.
  - Use weight.
  - For small items consider using creative solutions like rubber bands or clothes pins. Be imaginative!

3. Find a way of spreading a uniform, thin layer of glue over the edges to be joined. A popsicle stick or small piece of wood or cardboard works well.

### GLUING HINTS

- Clean up dribbles **before** they dry. A warm wet rag is best.
- To open plugged nozzles try pushing in a pin or small nail, or tap the nozzle with a hammer – gently if it is plastic.
- Pushing the pieces together too tightly will force all the glue out, "starving" the joint and making it prone to failure.



### BEFORE THE NEXT MEETING

- **Activities before the next meeting:** You might wish to try to drill other holes: larger, smaller, too a certain depth, or lining up two pieces to be joined and then drilling for dowels or screws.

- **Tools and Materials:** If you have them bring goggles, sandpaper (80 to 180 grit), a sanding block, clean cloths, penetrating oil finish, paint brush, rubber gloves, steel wool (# 0000) and pieces of wood. Bring markers, woodburning tool, acrylic paint and samples of decorative painting.

# Finishing Touches

## ROLL CALL

Describe, name or draw the different types of joints you found in wooden items in your home. Were there some joints that were hidden?

## *Hand Sanding*

Sanding is the first step in the finishing process. It will make the surface smoother and safer. It also prepares the article for a protective coating of paint, stain or clear finish. This is a stage where it pays to take your time and really do a good job. The end results will clearly reflect all your time and effort.

## TYPES OF SANDPAPER

Sandpaper is made up of small pieces of stone or glass, called **grit**, glued onto a support of paper or cloth. On the back of the sheet you will see a number. This refers to the grit size – the lower the number, the larger the grit. For example:

- 60 to 80 grits are coarse
- 100 to 120 grits are medium
- 150 to 180 grits are fine
- 240 plus grits are very fine.

Another difference in sandpapers is in the type of material used for the grit. Flint is the cheapest, softest and wears out quickly. Garnet paper cuts faster and lasts longer than flint paper and can "sharpen" itself. Aluminium

oxide paper is slightly more durable and more expensive. In the very fine grits you can get self-lubricating sandpapers. These silicon-carbide papers allow you to do a super fine finish.

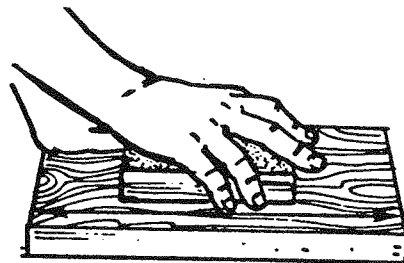
## SANDING TRIALS

Sandpaper is probably the safest tool you will use. Experiment on a piece of softwood to see if this "safe" tool can cause damage. Try different grits, in a different order and in different directions.

- What happened?
- Which grit worked the fastest?
- Which gave the smoothest finish?
- Which order worked the best?
- Did a particular grit or direction cause scratching?

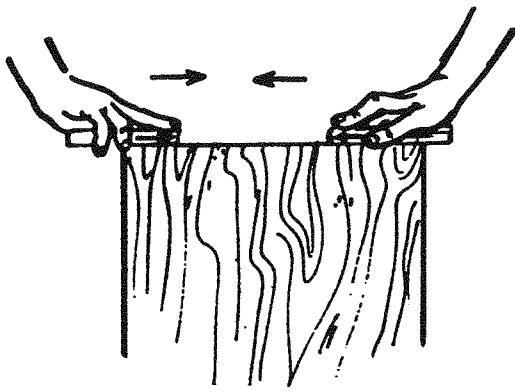
## SANDING TIPS

- When sanding, always work up and down the length of the grain. This prevents scratches. The coarser the grit or the softer the wood, the worse the scratches can be.



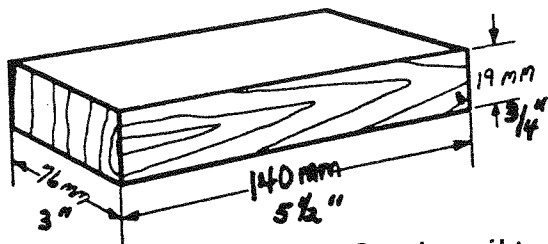
Sand with the grain

- When sanding, begin with a coarse paper and in two or three steps work to a fine paper, e.g. 100 to 150, then 200 grit paper. Coarser grits work faster, but the finer grits produce the smoothest finish. Taking care at each stage pays off in the long run.
- Checking for smoothness is best done with the hand, **carefully**. Gently run your hand up and down the board to locate rough areas. Lighting the piece from the side can help you to see them too.
- On end grain, work from the edges towards the middle of the board, particularly with coarse sandpaper. If you work the opposite way and push on the edge fibres, you may cause chips to break off.



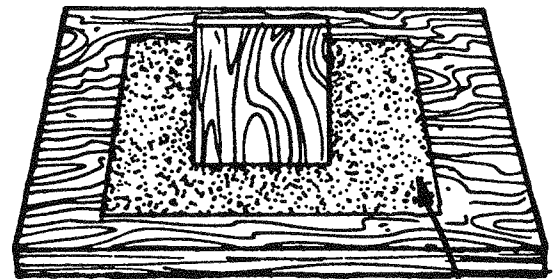
Prevent corner chipping

- A wooden or cork block large enough to wrap a quarter sheet of sandpaper around is a handy aid. It increases the area you are working on and prevents you from making furrows. These are grooves cut into the wood by the paper as it rubs against it.



Sanding block

- Tap the sandpaper on the back when it becomes clogged with dust to help prevent scratches. Non-clogging alternatives to fine sandpaper are steel wool (various grades) and plastic scouring pads. These work very well at the final stages of "sanding."
- When sanding along the edges, avoid uneven pressure that will round the corners down. The clean, crisp appearance of a square corner is usually preferred. Clamp pieces of scrap wood just slightly below and along the edges, just before sanding; to prevent rounded edges. If you want a rounded edge for looks or for safety, you *can* sand it round. However, woodworkers will usually round edges by cutting with a table saw or shaping with a router bit, long before the sanding stage.
- If you are sanding very small pieces, a piece of sandpaper glued onto a plywood board makes the job much easier.



Keep board square as you move it.

Board with sandpaper attached.

- With a little experience you will get to know which grits to use and how much sanding is needed.
- When you have finished sanding, wipe the board off with a lint-free cloth. Then check for any last pencil marks, dents or rough areas.

## CAUTION:

- Some people are allergic to sawdust. A face mask can help. Taking care to sweep up frequently can also reduce the problem.

## *Wood Finishes*

Finishes may be described by the kind of job they do, or the manner in which they do that job.

### JOB OF FINISH

#### PROTECTIVE

Protection is the main reason why we finish wood. Finishing makes the wood more resistant to dirt, stains and moisture. By sealing the grain, it also reduces the likelihood of warping. A protective finish is essential if the article is used outside, and wise even if a durable wood is used. For interior use, a protective finish is still necessary to protect against the wear and tear of daily use and damage from liquids like water or drinks.

#### DECORATIVE

Wood is also finished for beauty. This could be a clear finish that highlights the figure or shading of the wood. It may also be colour painted over the wood, perhaps providing pattern.

Often there are instances when a finish both beautifies and protects the wood.

### TYPES OF FINISH

No matter how they are made, finishes are of two basic types. They either **penetrate** into the wood, or they **sit on top of it**.

### PENETRATING

Oil and most stains and preservatives are penetrating finishes. They seep into the wood fibres and dry. These finishes allow you to still feel the wood. There is no "layer" that can lift off or be chipped. However, they are also finishes that can't be removed, unless some wood is removed.

When it comes to oil finishes, several different types are used. These include linseed, tung, teak, Danish and polyurethane oils. Oil finishes are easier to apply than varnish. While they may not be as resistant as a finish, they are also easier to restore and maintain.

### SURFACE LAYER

Paint, shellac, lacquer and varnish are all finishes that sit on top of the wood. They protect by enclosing the wood within a solid layer. This layer however, can be damaged by rubbing, denting, chipping and peeling.

These finishes can be clear or opaque. Clear finishes include shellac, lacquer, varnish, oil and some stains. They are used when the wood's grain and figure are worth showing. Opaque (cannot see through) finishes like paint and some stains are used when the wood is not very special or when the article is made from many different woods. The paint or stain may serve as a background for very decorative designs. These may be painted or stencilled.

### USING OIL FINISHES

AIM: 

- To learn how to apply a penetrating oil finish.

NEED: 

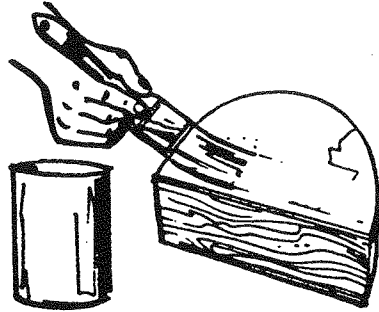
- Goggles or glasses.
- Clean, lint-free cloths, approximately 25cm (10") square.
- A small paint brush.
- Oil finish.



- Silicon-carbide paper (340 grit) or steel wool (0000 grade).
- Rubber or latex gloves.

DO:

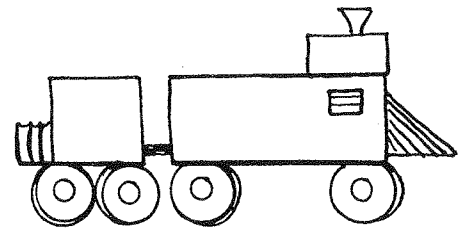
- Wad up the cloth to fit your palm and load it with the oil. This can also be done with a paint brush.



Apply an oil or penetrating finish for inside use.

- Apply a coat to the surface of the piece, being sure the grain is evenly wet.
- Rub the oil in using a circular motion at first, then change to follow the grain.
- Let the oil dry. Check the container's instructions for proper length of time.
- Lightly sand with the silicon-carbide paper.
- Apply more coats (1-3 more is average) until you are satisfied with the finish.
- After the final coat, use a small piece of steel wool to give the surface a fine sheen.
- Rub briskly with a soft clean cloth.

- HINTS:
- Stains can be used before an oil finish if they are compatible. The oil itself does darken the wood.
  - If you are using linseed oil and want it thinner to make it easier to apply, pour it into a container and set in very warm water.
  - For any articles used to prepare or serve food, or to be used by young children, use a non-toxic edible oil, i.e. tung or olive oil.



- Approximate drying times:
  - polyurethane - overnight
  - teak and Danish - 12 hours
  - linseed and tung - 1 to 3 days.

**CAUTION:**

- Use latex rubber gloves to avoid skin contact.
- Always work in a well-ventilated area to avoid excess fumes.
- Rags or steel wool with oil can cause a fire as they dry. Place oil-soaked materials in a bucket of water overnight before disposing of them.

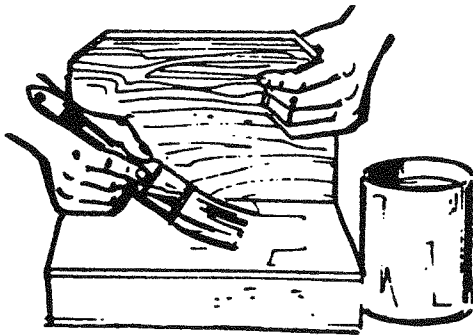


## TIPS ON OTHER FINISHES

### STAINS

Stains are applied much like oil. For small pieces you can use a cloth to apply the stain. For larger projects use a paint brush. Follow instructions on the container for drying time. Some uses will require more than one coat.

Many stains are intended only to improve the look of the wood. They require a protective finish over them. The type of stain you use must suit the finish you choose, or the stain may "lift." Stains intended for exterior use have protective qualities to them, and are generally used on their own.



Apply an exterior stain for outside use.

### VARNISH

Varnishes based on polyurethane are the most common. They are available in flat, satin or gloss finishes. It's important to have your workplace free from dust and use a high quality brush.

The wood's surface must be well prepared to yield a good finish with varnish. Pores, holes and cracks must be filled. The piece must be well sanded and cleaned with mineral spirits if there is any wax or grease.

The varnish is brushed across the grain first. Then, with gentle pressure, the brush is drawn

diagonally across the grain, and finally with the grain. After the varnish is completely dry, use fine silicon-carbide paper to smooth out the surface lightly. Repeat with another layer or two of varnish until you're satisfied with the finish.

### PAINT

Paint acts similarly to varnish because it too forms a layer on top of the wood. Paints can be water-based (latex) or oil-based (alkyd). For a good finish follow the same directions for surface preparations as given under varnish. To begin the painting process use a priming paint. This paint is designed to bond extra well to the wood, and provide a good grip for the final paint. Two coats of the finish paint may be needed.

Paints used for folk art painting differ somewhat. These are generally acrylic and dry quickly. Used for decorative effect, they may go on in a single coat. They need a protective coat like varnish on top.

#### CAUTION:

- Read and follow the directions and precautions on the product label.
- Avoid skin contact by using latex or rubber gloves.
- Work in a well-ventilated area to reduce the concentration of fumes.
- All products have the potential to harm the environment, so please handle them properly.

## Meeting One

### Word Associations

Materials required:

1. Masking tape
2. Flash cards with word associations written on them – enough for one for each member

Give each member a flash card with a word on it and a piece of masking tape on the back. Explain to the members that the group will be pairing off using word associations.

While members tape their word to their clothing, the leader explains that each of their words matches or compliments someone else's. Time is then given for each member to find his or her partner.

Once they find each other have them get to know each other by stating: name, number of projects completed, school grade, hobbies, age etc.

Have the group get back together and share newly learned information from their partners.

- |                      |                           |
|----------------------|---------------------------|
| ▪ Hammer and nail    | ▪ Tree and leaf           |
| ▪ Ice cream and cone | ▪ Book and shelf          |
| ▪ Table and chair    | ▪ Nut and bolt            |
| ▪ Soup and crackers  | ▪ Peanut butter and jelly |
| ▪ Key and lock       | ▪ Guitar and strings      |
| ▪ Pilot and airplane | ▪ Batman and Robin        |
| ▪ Pencil and eraser  | ▪ Salt and pepper         |

### Brainstorm

Materials required:

1. Flipchart
2. Markers

Have a discussion with the group about what they want to learn in the club, why they joined the club, items they would like to make, special projects they would like to complete, places they would like to tour, achievement ideas etc. Write these down on the flipchart (or have an older member do so).

At the end of the club, you can revisit these ideas and see how many expectations the club met.

For project ideas and patterns, visit [http://www.oznet.ksu.edu/library/4h\\_y2/4h167.pdf](http://www.oznet.ksu.edu/library/4h_y2/4h167.pdf).

## For Senior Members – Career Exploration

- Visit <http://srv108.services.gc.ca/english/profiles/201.shtml> , or [http://www.skillscanada.com/en/educators/profiles/index\\_carpentry.php](http://www.skillscanada.com/en/educators/profiles/index_carpentry.php) and discuss the skills needed to become a carpenter. For an in-depth activity, have senior members research these skills using the above websites, and present their findings to the group at the next meeting.
- To enhance this activity, invite a speaker from local apprenticeship branch, community college or trade school; or The United Brotherhood of Joiners and Carpenters (<http://www.carpenters.org/common/locals.html>) to talk about a career in woodworking.

## Description Duet

Materials required:

1. Flash cards with the following items written on them: workbench, safety goggles, saw, drill, hammer, wood and other woodworking items

Set the stage by holding up a card with a word written on it (for example, pencil) and ask the members to pretend they don't know how to use it. How would they describe it to someone else? What would they say about it? They might say, "It's long, thin and bright yellow. It has a sharp point on one end and soft rubber on the other".

Have members sit in a large circle. Each member gets a card with a woodworking item written on it and they have to describe the woodworking item. Once the item has been identified, discuss as a group safety measures needed to prevent the dangers – use the following pieces of information to guide the discussion.

*Eye Protection-* If you're in the shop, you need to have eye protection. Even when you are only using hand tools, chips can fly.

*Ear Protection-*When power tools are being used, everyone in the shop needs to wear ear protection, not just the people operating the tools.

*Dust Mask-* When doing something that generates fine dust (like sanding), dust masks are strongly recommended. If you have any allergy or asthma problems, they're required.

*Unplug Power Tools-* If the tool isn't being used, it gets unplugged. That way, it can't get turned on by accident.

*Keep Your Work Area Neat!* - Clutter causes accidents.

*No Horseplay - Keep Tools Sharp and Clean - Pay Attention!*

## Interactive Games

Materials required: computer with Internet access

- Take a virtual tour of a woodworking shop at <http://www.signit-signs.com/woodworking-room.html>

## Meeting Two

### Measuring Tips

No materials required.

Read the information on the following page about measuring tips for accuracy to decide which sections are most relevant to the group and then discuss ideas that the members have about being accurate in measurements.

### Your Personal Strengths

Materials required:

1. Hard piece of wood
2. Hammer
3. Nails

Have members sit in a circle and have the tough piece of wood in the center of the circle with the hammer and nail.

Count how many times it takes each member to hammer the nail fully through the piece of wood.



## Meeting Three

### Identify that Wood

Materials required:

1. Several samples of different types of wood, their leaves, and if possible, their nuts

Have the samples all numbered including the leaves and nuts.

Have members write down in their books which leaves they think match the samples of wood and nuts.

Take up answers after a specified amount of time – this activity can be done outside.

### Deforestation Debate

Materials required:

1. Copies of the following information for all members

Have members take the following information and turn it into a PowerPoint slideshow, a poster board presentation, or some other public way of presentation.

After they have displayed their work (and have hopefully learned the information), break the members into two groups and hold a debate.

From <http://www.carefortheearth.com/index.php?categoryid=8>

*Forests around the world are quickly shrinking. For example, in the Brazilian Amazon, 29,000 square kilometres were deforested in 1995. Though the number decreased in 1996 (18,100 km<sup>2</sup>), it is still substantial. Deforestation affects developed and developing countries alike: the problem is particularly acute in South America, Africa, Southeast Asia, Australia and war-torn countries. For governments, forests represent untapped resources. In addition to the financial gains from commercial logging, forests are safety valves for overpopulation and landlessness. In Brazil, settlers from the coast were given whatever land they deforested. In Indonesia, deforesting by landless migrants led to large-scale smog pollution in 1997. Logging was used by the Khmer Rouge to fund its civil war in Cambodia. In Africa and South America, wood is used as fuel. Deforestation has substantial side effects: it can endanger species and lead to large-scale fires. Environmentalists argue that governments should outright ban logging. In North America, there have been violent clashes between logging companies and conservationists. In the 1990s, the World Bank stopped lending to logging companies after lobbying by environmental NGOs. Today, the Bank will lend to companies that practice "sustainable harvesting". No more clear-cutting and over-harvesting; the Bank promotes low-impact logging and "sustainable use".*

The following logging advantages / disadvantages can also be used to guide the debate.

### **Pros**

The environmental effects of deforestation are exaggerated and, in any event, are irrelevant to developing countries. Some scientists estimate that deforestation, if continued at its current pace, will only reduce species in tropical forests by 5 – 10% in the next 30 years. For developing countries, there is the belief that rapid deforestation and rapid development are linked. Indonesia subsidizes its forest industry through export taxes. The revenue from commercial logging is substantial. Further, in Brazil and Indonesia, there are programs promoting migration from heavily populated urban centers to deforested areas. Without this migration, Bali, Java and Brazil’s coastal areas would become unbearably overpopulated.

Deforestation should not be used for political purposes, and there are mechanisms for controlling such actions. Prohibiting logging would go too far. In Kenya, the courts ordered the government to protect the Ogeik. The decision to deforest the Mau forest was clearly illegal. Further, the World Bank’s new program will “crowd out” such unsustainable or illegal practices. Logging companies and governments that need World Bank loans to finance their forestry operations must comply with its rules regarding “sustainable harvesting”.

### **Cons**

Deforestation has long-term environmental impacts. There is a causal connection between deforestation and climate change and loss of biodiversity. In Brazil, burning trees has made the rainforest drier, leading to more fires. Scientists estimate that tropical rainforests have half of all the world’s species. The Amazon rainforests contain 400 human tribes. Deforestation dramatically affects genetic variation, which can aid in reducing the effect of diseases and famine.

Deforestation is a tool for politics. Governments use deforestation for political gain, either through increasing revenues from logging companies or in providing land to landless migrants. In Kenya, the government logged 68,000 hectares of the Mau forest. Their objective is to disperse the Ogeik people, an indigenous tribe, to make room for the majority Kalenjin. The World Bank’s plan to fund “sustainable harvesting” is not enough – its forestry policy will be irrelevant unless it can stop subsidies for agricultural expansion and road-building programs.



## Making a Willow Whistle

from <http://www.mathematische-basteleien.de/flute.htm> - used with permission.

Materials required:

1. Piece of willow branch for each member
2. Sharp knife (ensure you have enough supervision for younger members)

Look for a willow stick where the space between two branches (buds) is as long as possible and with a constant diameter (1 cm = 0.4 inches or more).



Cut the willow branch perpendicularly to the direction of the stick with a sharp knife. Cut the stick on the left later, when the whistle is finished.



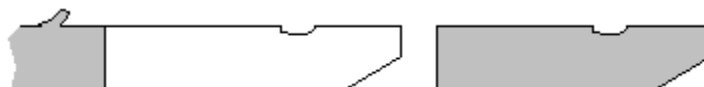
Cut the end on the right obliquely.



Remove the bark, so a rind is formed. Cut a flat notch on the top, but not too much on the right. Otherwise, there is no place for the mount piece.

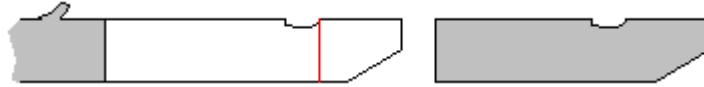


Removing the bark is the most difficult part. Hold your right hand around the bark and firmly grasp the stick with your left hand. Turn the bark carefully – if the bark doesn't move, lay the stick on your knees and tap at every spot with the handle of the knife. Then you can usually skin the stick and remove it to the right.



Cut the mouthpiece perpendicular to the direction of the stick.

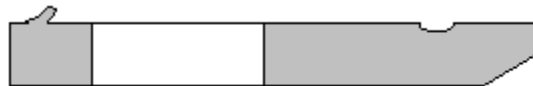




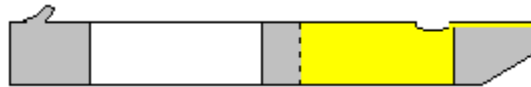
Cut a flat slice from the mouthpiece at the top, so that a stream of air is possible later. Don't cut too much – it is better to extend later.



Put the tube from the bark on the stick and fit in the mouthpiece. The willow whistle is finished.



You can see the airspace in the following drawing, which oscillates when you blow into the whistle. You can change its length to change the sound. The bark becomes dry after a few days and the whistle will no longer work.



For more information on willow whistles, you can visit:

- [http://en.wikipedia.org/wiki/Willow\\_flute](http://en.wikipedia.org/wiki/Willow_flute)
- <http://schizoffective.org/whistle/>

## Meeting Four

### Nails, Nails and More Nails

Materials required:

1. Many nails of various sizes and shapes
2. Stop watch
3. Paper
4. Marker

Time each member as they sort the various nails into piles of similar nails.

Record each member's name and time required to sort all the nails.

After everyone has had a turn, see how many members can identify the types of nails and their use.

### Hammerhead Quiz (for Senior Members)

(Adapted from <http://www.hammernet.com/quizes.htm>. For more information and activities on hammers, you can check out Hammernet at <http://www.hammernet.com/index.htm>)

Materials required:

1. Chart paper
2. Marker

Have members match the term on the left with the definition on the right.

Hammerlock	Norwegian island town
Armand Hammer	Term for a bird and a shark
Hammerfest	A grappler's move
Knight of the Hammer	Composer loved by Lutherans
Hammertoe	American industrialist
Hammerhead	Problem for a foot doctor
Hammer and sickle	Inner borough of London
Oscar Hammerstein II	Symbol of defunct superpower
Hammersmith	Dick's librettist
Andreas Hammerschmidt	Smithy

## Hammer Safety

Materials required:

1. Poster paper
2. Markers
3. Pencil crayons
4. Crayons

In pairs or individually, have members design and create a poster illustrating hammer safety and make sure they include the following pieces of information (make sure they use their imagination and bright colours to get their message across to their audience):

- Make sure the handle of the hammer fits tightly on the head.
- Do not strike a hard steel surface with a steel hammer. This may cause small pieces of steel to fly and injure someone.
- Do not use the hammer handle for striking, and never use it as a pry bar. This may cause the handle to split which could result in a cut or pinch to the user.
- Always strike the surface squarely – avoid glancing blows.
- Always wear safety goggles.
- Never strike any hammer with or against another hammer.
- Discard a hammer with a chipped or mushroomed face.
- Do not use steel hammers on concrete, stone, or hard metal objects.
- Replace loose or cracked handles
- Discard hammers with cracked claws or eye sections.

## Meeting Five

### Comparing Strengths of Glues

Materials required:

1. Several brands of wood glue
2. Pieces of scrap wood to glue together

Have members judge several types of glue by using the same amount of different types of glue on different pieces of scrap wood and seeing how well they hold when they try to pull them apart.

Use the following information to help guide discussion during the activity.

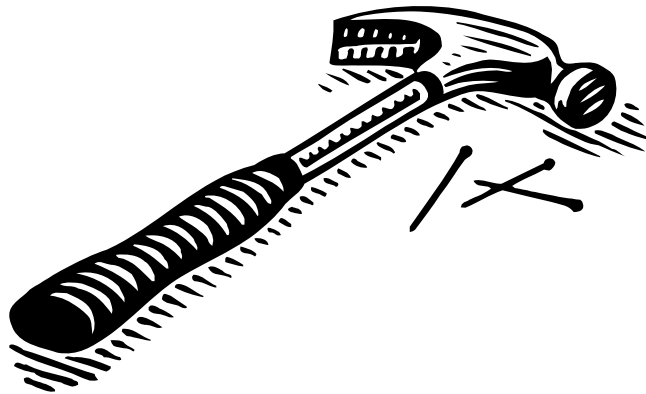
What is the difference between wood glue and regular white glue? Regular white glue is PVA adhesive (polyvinyl acetate), acceptable glue for wood that will be stronger than the wood itself. The PVA adhesive was invented in the early 1950's (Elmer's glue). Since then it has been improved and now we can choose from yellow glues (Carpenter's Glue, Titebond, etc.) and cross-linking PVAs (Titebond II).

### Interactive games

Materials required:

1. Computer with Internet access

Play a tool matching game at <http://www.am-wood.com/games/games.html>



## Meeting Six

### Guess that Paint

Materials required:

1. Latex paint
2. Oil paint
3. Piece of wood
4. Paint brush
5. Oil / latex paint indicator

Have oil and latex painted on a piece of wood side by side in the same colour and then use the indicator paper to see if it is latex or oil.

Have members discuss the differences between the two paints – are they noticeable?

### Human Map

Materials required:

1. Flash cards with the following items written on them: drill, hammer, nails, workbench, safety goggles, wrench, pliers, ruler, measuring tape

Make sure there is an open area for the group to work in. The members can sit or stand and they need to organize themselves into a living set of a woodworking shop. For example, one person is a workbench and describes the possible dangers and possible safety precautions that should be taken around this item.

### Brainstorm

No materials required.

Have members talk about things they liked / disliked about the club, things they would have done differently, activities they would like to see included.

Also read through the following information and try and include it in the meeting.

### On Site Finishing of a Product

From [http://www.hardwoodinfo.com/display\\_article.asp?subID=71](http://www.hardwoodinfo.com/display_article.asp?subID=71)

The following is a step-by-step guide to on-site finishing: (remember to follow all manufacturers' recommended safety procedures).

Prepare the room. Keep dust to a minimum and maintain stable levels of temperature and humidity. Seal doorways with plastic film, and schedule other workers away from the job site. Mask off any surfaces you wish to protect.

Seal it. Solid hardwoods must be sealed on all sides because moisture can pass through the back, edges or ends as easily as from exposed faces. To avoid shrinking, swelling and damage, you should pre-coat surfaces that you won't be able to reach after installation. For strip flooring sealing the back is not generally done. However, sealing the back of wide plank is recommended. Also seal any ends and edges that abut a surface exposed to moisture, such as an exterior doorway or ceramic tile floor.

Smooth it. Sanding is critical to an attractive, durable finish. Items like paneling, stair rails or cabinetry usually require only light sanding. Hardwood flooring needs to be sanded at least three times, with successively finer grades of paper. Sweep and vacuum the floor thoroughly after each sanding. Spot filling and other minor repairs should be taken care of before the final sanding pass.

Keep the surface clean. Smooth any flaws that appear, then remove dust with a brush, broom and / or vacuum.

Stain it. Apply stain generously with a brush, rag or lambswool applicator. Allow it to sink in, and remove the excess according to the manufacturer's directions.

Seal and finish coats. When the stain is dry, brush on the first finish coat and let it dry according to the manufacturer's directions. Drying or curing times will vary depending on the type of finish you use. When it's bone dry, sand the surface with 150-to-180 grit paper, #1 steel wool, and / or an abrasive pad. Sweep and vacuum to remove the dust. For flooring, wrap a push broom with a lint-free cloth lightly dampened with water. Wipe the surface clean.

Sand, clean and coat again. The second or third finish coat will usually give you the desired result.

# Woodworking

## Level II



Name \_\_\_\_\_ Age \_\_\_\_\_

Club \_\_\_\_\_



Ontario  
4-H Council



Ontario  
Ministry of Agriculture,  
Food and Rural Affairs

4-H 2490 94 MIIE

# THE 4-H PLEDGE

"I pledge:  
My Head to clearer thinking  
My Heart to greater loyalty  
My Hands to larger service  
My Health to better living  
For my club, my community and my country."

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*The primary purpose of the 4-H program is the personal development of youth in rural Ontario.*

## ***Introduction***

Welcome to the 4-H Woodworking project. Each of you has come with different skills and ideas of what you would like to learn. Great! Hopefully all members will find the project enjoyable and rewarding. And, having different skills you will all be a help to each other.

Wood has been a valuable resource for our country since pioneer times. As a material it remains easy-to-use, relatively cheap, and fairly versatile. This means woodworking can be a handy skill to have. During the project you will have a chance to try, or perhaps improve, skills such as sawing, hammering, drilling, gluing and clamping.

Throughout the project you will also learn about some of the properties of wood. You will find out how lumber is described – by category, size, species and grade. Information about basic properties such as grain, hardness and suitability for certain jobs is also included. Most of this helps us understand why wood behaves the way it does, and how to work with it best.

## ***Objectives***

As a member of this project we hope you have fun as you develop some understanding of:

- Wood's basic properties;
- How different woods vary and why they are used the way they are;
- The skills required to work with wood;
- The importance of wood in both the manmade and natural environment.

## ***General Requirements***

A member will complete a project satisfactorily by:

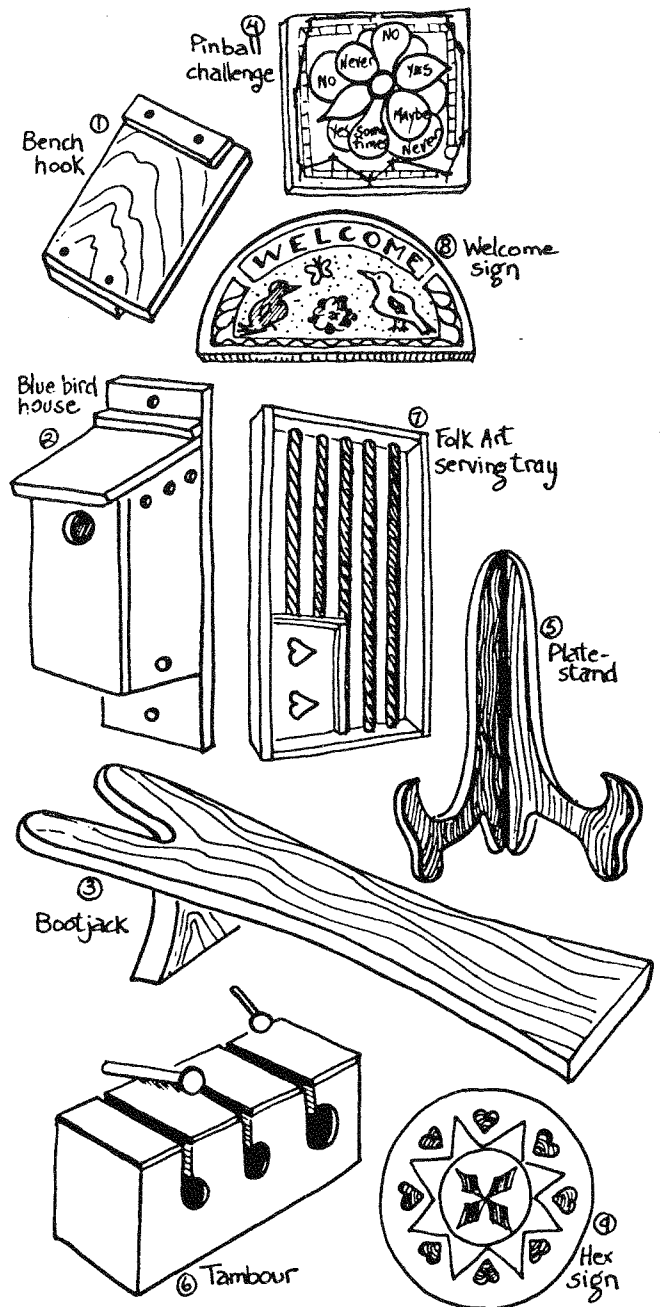
1. Participating in at least 2/3 of his/her own club meeting time;
2. Completing the project requirements to the satisfaction of the club leader(s);
3. Taking part in an Achievement Program.

## ***Specific Requirements***

1. Make the safety of yourself and others your number one concern.
2. Approach activities and projects with a willingness to learn.
3. Show proper respect for tools, both for safety reasons and to keep tools in good shape.
4. Find someone who can act as a "home helper."
5. Have fun as you learn.

## Project Ideas

1. Build your own bench hook. This simple device helps you saw pieces for future projects.
2. Construct a bluebird box. Add more difficult joints to increase the strength of the box, and the project's challenge.
3. Fashion a simple boot jack from two pieces of hardwood.
4. Create a pinball machine with wood, plywood, plastic spoons, rubber bands, push pins and wooden spools. The machine's design and decoration can be as complex as you like.
5. Using a coping saw, hardwood, and some hinges, make a plate stand.
6. Make a sound box known as a tambour with plywood and a saw.
7. With plywood and some lath (fine, thin strips of wood) create a folk art tray or plaque.
8. Make a welcoming sign with some wide pine boards, permanent coloured markers, and a coping or jig saw.
9. For a slightly more difficult project, make an animal or hex sign. This can be displayed inside or out, depending on the materials and finish chosen.



**PLEASE NOTE:** The ideas for these projects are only suggestions. Many of them emphasize use, over beauty or finish. All of them can be altered to suit your own interests. You will find other good ideas for plans in books at your local library, or in your own imagination. Adding extra details, or choosing different materials or finishes, you can increase or decrease the difficulty of a project. (Remember: If you change details like the type of joint, the length of a piece can change. Go over your plans with your Leader to make sure you have not overlooked these and other necessary changes.)

## *Meeting Schedule*

	DATE	TIME	PLACE
MEETING ONE			
MEETING TWO			
MEETING THREE			
MEETING FOUR			
MEETING FIVE			
MEETING SIX			
ACHIEVEMENT PROGRAM			

The 4-H Resource Development Committee of the Ontario 4-H Council reviews and evaluates 4-H resources. Comments and suggestions about 4-H manuals and guides are always welcome. They may be sent to the following address.

4-H Resource Development Committee  
c/o Guelph Agriculture Centre  
P.O. Box 1030  
Guelph, Ontario  
N1H 6N1

# GET INVOLVED

Be willing to let your name stand for an executive position. It is a rewarding and fun experience. Following your club's elections, complete this club executive chart.

## CLUB EXECUTIVE:

	<u>Name</u>	<u>Phone</u>
PRESIDENT	_____	_____
VICE-PRESIDENT	_____	_____
SECRETARY	_____	_____
TREASURER	_____	_____
PRESS REPORTER	_____	_____
OTHER	_____	_____

## CLUB MEMBERSHIP:

Members, Phone

Members, Phone

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Leaders, Phone

Leaders, Phone

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\_\_\_\_\_  
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OMAFRA Contact, Phone

4-H Association Contact, Phone

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# Essential Resources

## ROLL CALL

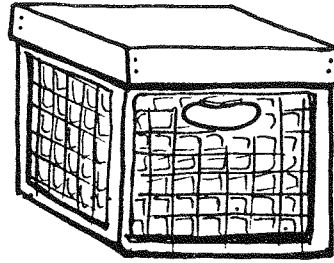
As you introduce yourself, explain what interests prompted you to come to this 4-H project. What would you like to learn?

## Essentials

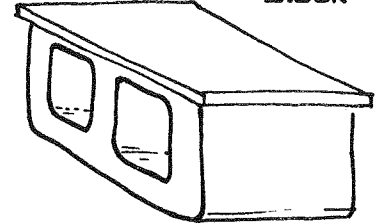
### WORKBENCH

Depending on your time, money and interests, you might like to tackle building a milk crate workbench or a sawhorse. In pairs, sawhorses are great for holding large pieces of material such as a 4 x 8' (1.22 x 2.44 m) sheet of plywood. Some designs of sawhorses have wider tops than usual, and these can serve as a reasonably good work surface too.

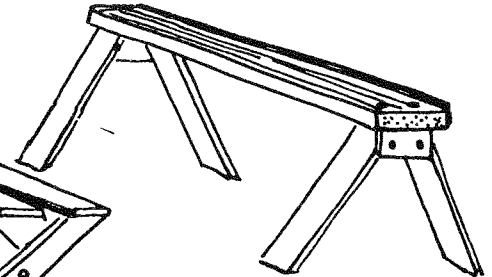
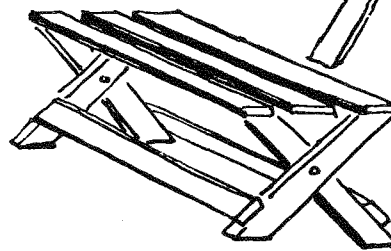
Milk crate with cover



12" double corner concrete block



Picnic bench with braces



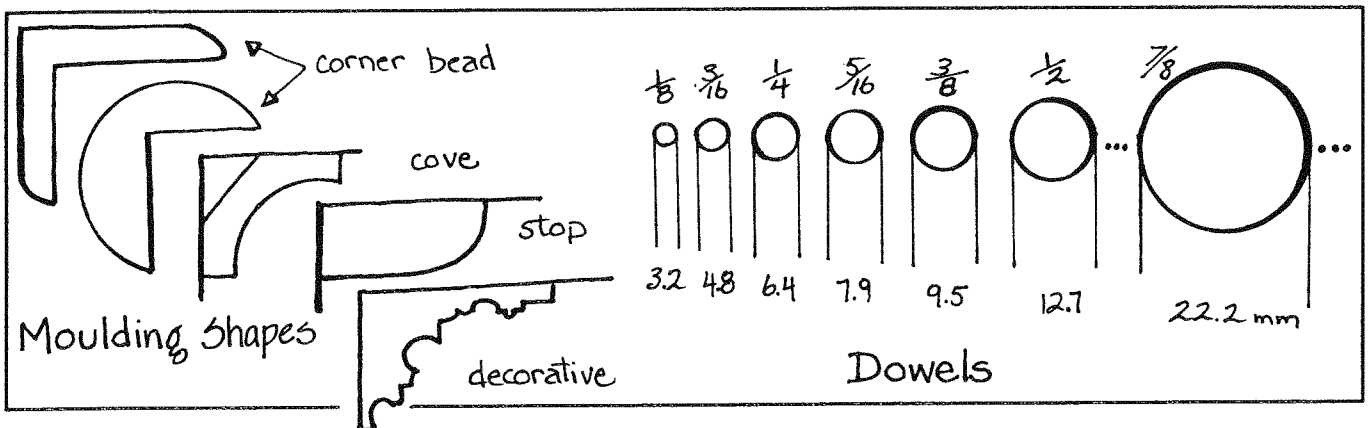
Saw horse

## Facts And Figures

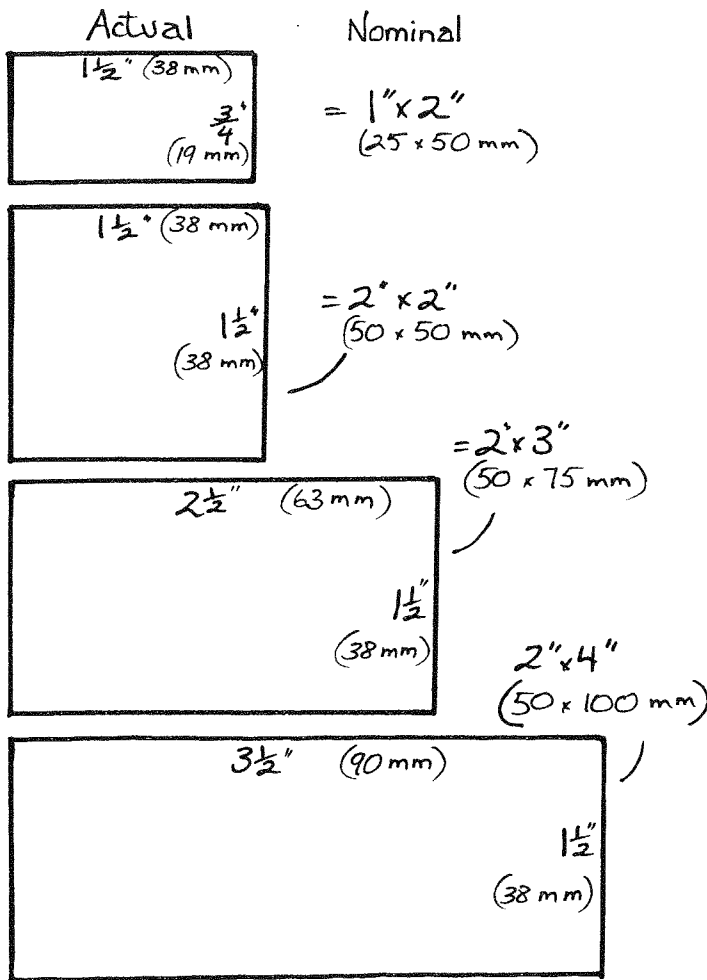
### WAYS TO DESCRIBE LUMBER

Wood is available in a wide range of shapes, sizes, lengths, grades and species.

**SHAPES:** Lumber can be round (dowelling), square, rectangular or any number of decorative mouldings which combine curves and rounded edges in their profile.

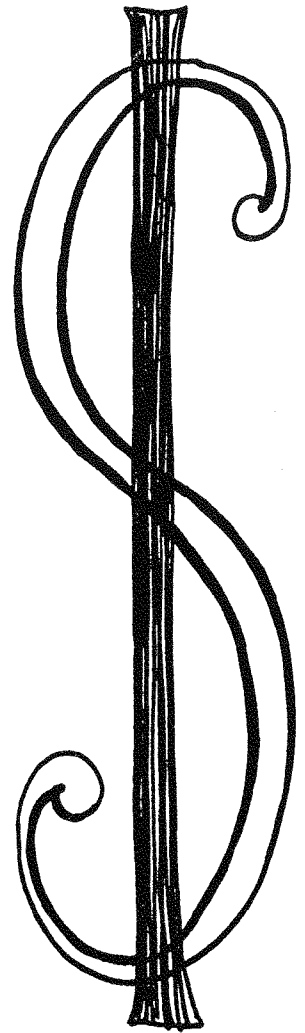


**SIZES:** The size describes the dimensions (measurements) of the lumber when it was first cut. These are known as its **nominal** measurements. To beginning woodworkers this is confusing, since all lumber is smaller than its name indicates. Shrinkage from drying, and often losses from planing it smooth, have reduced its size. Standard sizes for rough construction (framing a house etc.) include 2 x 4" (50 x 100mm), 2 x 6" (50 x 150mm), 2 x 8" (50 x 200mm) etc. In fine cabinet work it's more common to work with 1 x 4" (25 x 100mm), or 1 x 8" (25 x 200mm) etc.



**LENGTH:** Lengths are quite standard with most lumber. Most are available in 8' (2.44m), 10' (3.05m), 12' (3.66m), 14' (4.27m) lengths. Occasionally, you can have a long piece cut to give you a different length, i.e. a 12' cut to provide either a 5' (1.5m) or 7' (2.13m) piece. This depends on the policy of the lumber yard.

**GRADE:** Lumber quality and price are determined by its grade. Whether hardwood or softwood, a high-grade board must have more knot-free and defect-free surface area than a low-grade board. With hardwoods, the top grades down are: first and seconds (FAS), selects and No. 1 common. Softwoods used in construction are graded differently. Commonly-available grades for 2 x 4" (50 x 100mm) etc., from the top down, include: standard, # 3 and economy. Naturally, the top grades are the most expensive. **Dressed** (planed) lumber is also more expensive than **rough cut** (unplaned).



**SPECIES:** Lumber is broadly categorized as a softwood (from a cone-bearing tree) or as a hardwood (from a flower-bearing tree). Softwoods are the choice for rough construction, while hardwoods are reserved for finish construction and cabinetry. They are harder to work with and are more expensive.

Hardwood



ie maple

Softwood



ie pine

## MAKING LUMBER

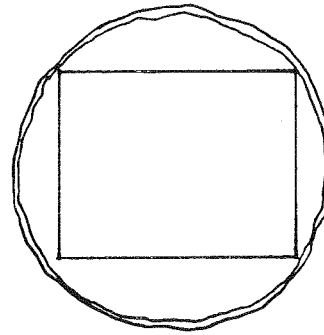
The trees are cut by chain saw or by huge machines. All branches are then removed. The logs are lifted, carried and loaded by large skidders (or in some areas by elephants) onto the trucks or trains, or onto the rivers that carry them to the sawmill.

At the sawmill they are cut into the recognizable shapes we see. The first operation squares the log into a **balk**, by trimming off the curved, exterior edges. The remaining lumber can be cut in a few different ways.

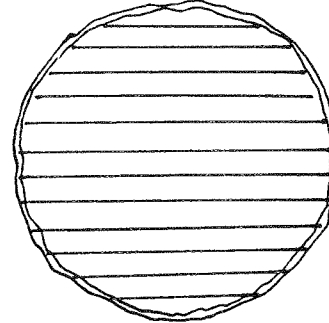
Through-and-through cutting takes slices, one after the other, through the balk. This method is also known as **flat-sawing** or **plain-sawing**. It produces wide boards, with little waste. However, many boards sawn this way have a tendency to warp. (The most likely ones can be identified by having an end grain which curves.)

The balk may also be **quarter sawn**. With this method it is cut into quarters, and each quarter cut at right angles to the rays. Rays are cells which are aligned from the pith to the bark; they are not found in all woods. Wood cut this way is least likely to warp.

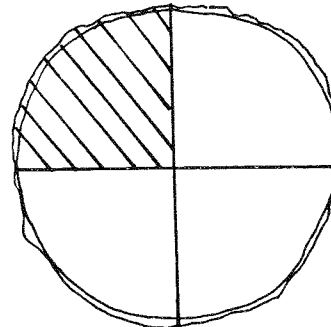
The balk may also be cut **tangentially**. This method produces many different sizes of boards, and a variety of grain patterns. Once again however, some of the boards cut this way are liable to warp.



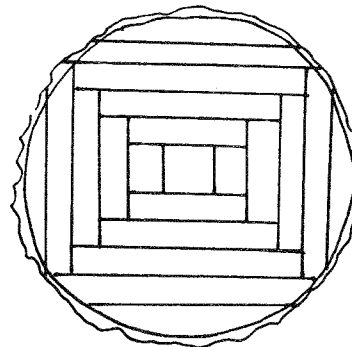
Balk



Through  
&  
through



Quarter



Tangential

---

## **BEFORE THE NEXT MEETING**

---

- For Roll Call at the next meeting, keep a wood diary for a day. Record every wooden item that you use or see. If certain items appear repeatedly, make note of how often. For instance, if there are wooden chairs at your kitchen table, and a wooden rocker in the living room, mark chairs a second time. Watch closely. You may not realize that some items are made from wood.
- Find a home helper.
- Organize a workplace at home.
- Decide on a project you would like to make. Choose a plan that sounds interesting and somewhat challenging. Avoid those which look too easy (they might be boring), or those which look too difficult (they could just be frustrating). The project should be something you can finish within the time you can give to it.
- Bring the following if you have them: goggles or glasses, pencil, measuring tape or ruler (metric and imperial), carbon paper, a pattern to trace and a piece of wood to fit the pattern, graph paper and a magnifying glass.



# Ready, Set, Go...

## ROLL CALL

Give your account of the wood items you used or saw in a day. How many were there?

## Facts And Figures

### SOFTWOODS AND HARDWOODS

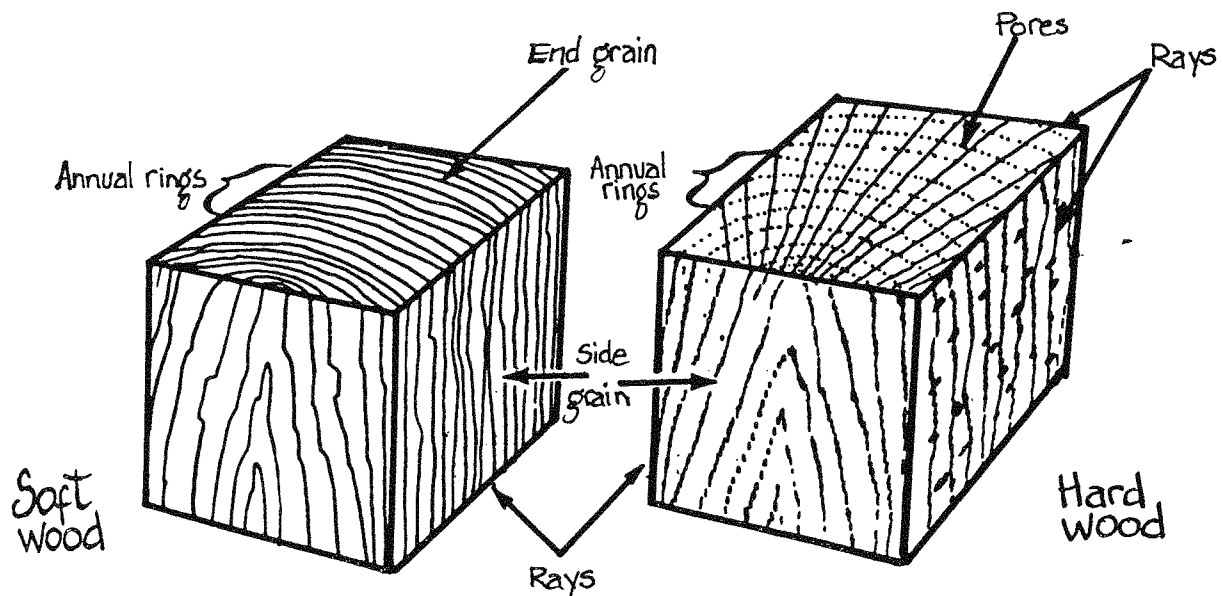
Lumber can be described by the species of tree (e.g. pine, maple) it is from. Of the thousands of species of trees that exist, about three hundred are used in the lumber industry. Only a handful of species are found at a typical lumber yard. These are broadly grouped as softwoods (cone-bearing, coniferous) and hardwoods (flower-bearing, deciduous).

Softwoods may vary in their lumber characteristics, but inside they are all the same. The main cells of all softwoods are **tracheids**. Tracheids are fibre-like, with pitted, fairly thin walls. These are somewhat blunt in shape. These features allow them to both strengthen

the tree and carry the fluid nutrients. Another noticeable feature of some softwoods is the presence of **resin**. Resin is a soft, sticky, clear substance exuded by special cells in species such as pine, larch, spruce and Douglas fir.

The cells in hardwoods are more specialized. The vessel is one such cell. These cells only carry fluids. Vessels are long pipelines formed of shorter tube sections called **vessel cells**. A second type of cell, **fibres**, provide the structural strength of hardwood. To do this job well, the fibres are long, tapered and thick-walled. They surround and support the vessels.

Most of the cells in the trunk of any tree run in the same direction as the trunk. Because vessels are hollow, they appear as **pores** when the trunks of hardwoods are cut across. This is why hardwoods are known as **pored** or **porous** wood. Certain hardwoods can be identified by the very distribution of the pores. Several species such as oaks (*Quercus*), ash (*Fraxinus*), and hickory (*Carya*) are **ring porous**. More pores are found in one part of the annual growth ring than the other, creating a "ring."



Softwoods such as spruce, fir and pine, are preferred for construction carpentry. They form the majority of wood stocked at building centres, and in the lower grades are the cheapest material. Hardwoods include maple, oak, cherry, black walnut and ash. Being more expensive, these are generally saved for fine cabinetry (furniture construction).

**REMEMBER:** These classifications are botanical. Not all hardwoods are hard, nor all softwoods soft. For instance, several southern pine species (softwoods) are harder than balsa (a hardwood).

## M & Ms

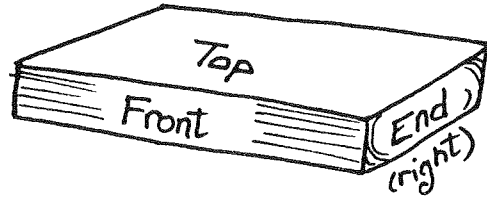
### DRAWINGS AND DIMENSIONS

There are several ways to depict an object. **Perspective** drawings show the object the way we see it. In a perspective drawing, object lines which appear to be parallel would actually meet if they were extended far enough.

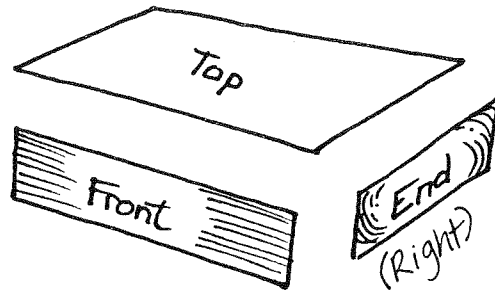
Lines in an **isometric** drawing are parallel. This lack of perspective makes distant parts of the object appear larger than the portion in the foreground. Isometric drawings are done on a 120 degree axis.

Sometimes views are **exploded**, so that each section is seen individually. Views are often visually rotated into what is known as **three view projections**. These are called **orthographic** drawings. They are the most common form of drawings given in plans. Drawn to scale, orthographic drawings provide the exact dimensions, and often a better understanding of the object.

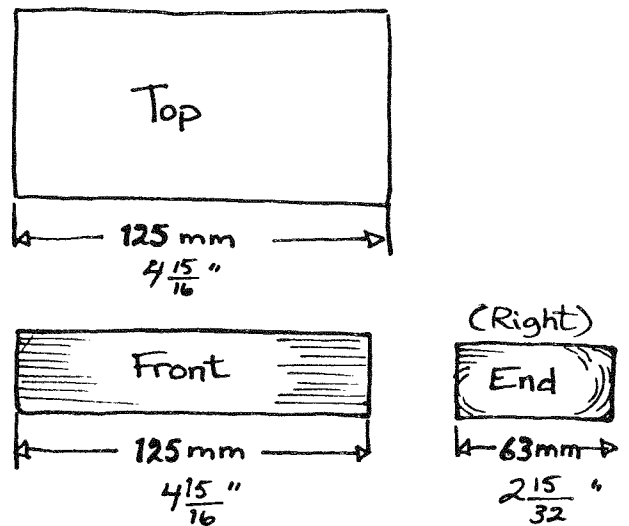
### Isometric



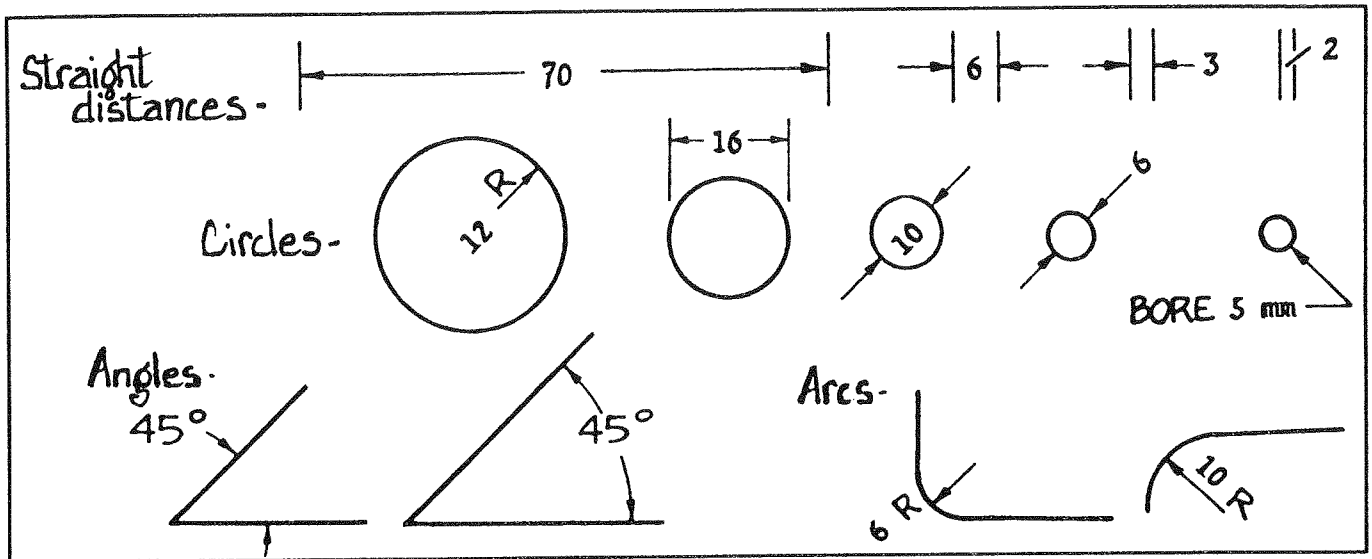
### Exploded



### Orthographic



There are many different ways of showing dimensions. Here is a sample of some you'll see.



### USING A GRID SYSTEM

In the past, you have probably used a grid system (layout of squares) to try and duplicate a particular picture. Grids can also be used to scale patterns up or down. This is done by simply changing the size of the grid.

- AIM: • To scale up a pattern.
- NEED: • Two sheets of paper (can be graph paper), a square or ruler and a pencil.
- DO: • Use graph paper, or mark out a piece of paper to make 1" squares.
- Try to copy a pattern, by marking the spots where an object line crosses a grid line.
  - Connect the marks to form a larger version of the pattern.
- HINTS: • Grids can be marked on working drawings, or on tracing paper you place over a drawing.

- The final version you want to work with can be traced onto the wood using carbon paper, or glued onto the wood, and sanded off later.

### BEFORE THE NEXT MEETING

- For the Roll Call of the next meeting, bring one of your favourite small wooden items – a spoon, jewellery box, bowl, etc. Why have you chosen it?
- Using imperial measurements, try measuring some of the items you noted in your wood diary. Or measure several kinds of the same item, i.e. chairs or tables. If so, how similar are they? In all dimensions?
- Tools and Materials: If you have them, bring in goggles or glasses, square (any kind), pencil, crosscut saw, coping saw, backsaw, rip saw, wood with pattern traced on it, C-clamps, mitre box, bench hook and some pieces of wood to work on (practice pieces and/or pieces for your project).

# Hip To Be Square

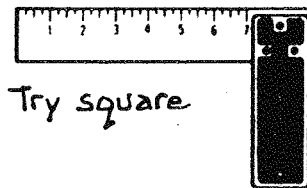
## ROLL CALL

Show the wooden item you selected and brought. Explain why you like it.

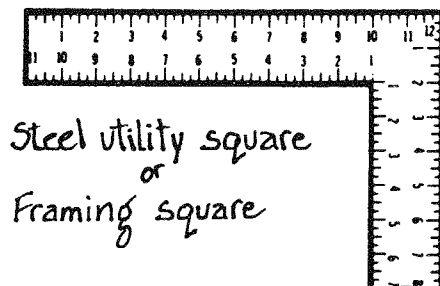
## *M & Ms*

### TYPES OF SQUARES

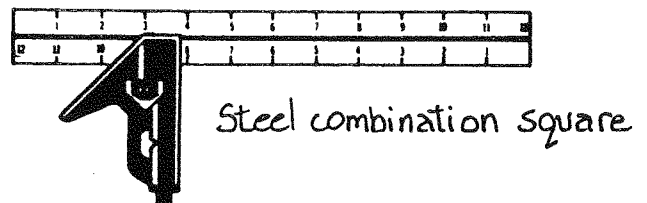
As with any tool, there are several types of squares. The try square is a small square, often consisting of a metal blade attached to a heavy, wooden beam. Its main purpose is to test, or try lumber to ensure its edges are at right angles to each other. It is also used to test how squarely pieces fit to one another.



The **framing square** is a large, steel square. It is used in the construction of buildings, where its greater length makes it more accurate. It is sometimes called a **utility square**.



The **combination square** is so called because its beam has two different angles. One side is used to mark 90 degree angles. The other marks 45 degree angles. This is used in making **mitre joints** – a right angle joint made of two 45 degree angles.



### MEASURING TIPS

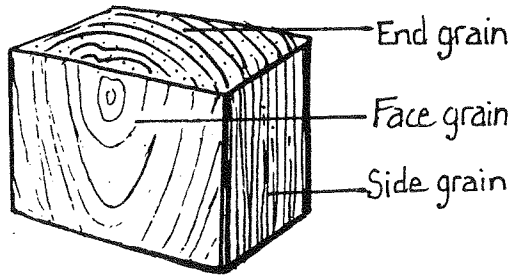
- Try to work with round numbers when you can for simplicity.
- Let the materials guide you. The dimensions are fairly consistent (thickness, width, and length). Consider these as building blocks and work **with** them.
- Let the project guide you. Look project plans over to see what dimensions are critical and what are not. This can be a useful step if you are limited by materials.

## *Facts And Figures*

### WOOD GRAIN AND FIGURE

A good way to learn about grain is to pick up a piece of wood. Look at the board. See the **grain lines**. The grain has a different appearance on each edge of the board.

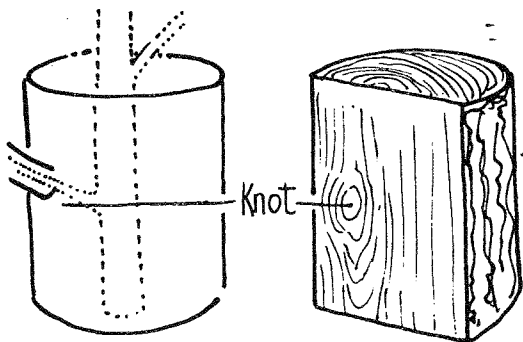
## Different Grains on a Board



The grain on the end is called **end grain**. The curve of the end grain can help you picture exactly how the board was cut from the log. These curves are the **growth rings** of the tree.

The fibres in **edge grain** appear side by side, in a fairly straight, parallel pattern.

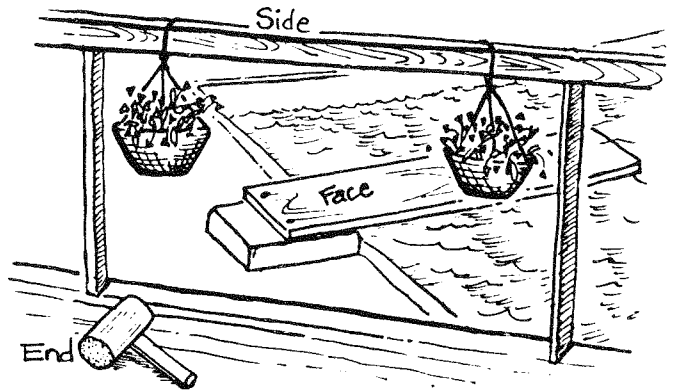
The **face grain** is on the face of the board, its broadest surface. The grain pattern is created by the way the growth rings pass in and out of the plane the saw has cut. This pattern is the **figure**. The figure may have curving or wavy lines and distinctive shading, depending on many factors. Outstanding figure is the main reason why some woods are prized above others. Sometimes the grain contains circular or oval irregularities called **knots**. These were the tree's first branches, long since overgrown.



## GRAIN'S STRENGTH AND WEAKNESS

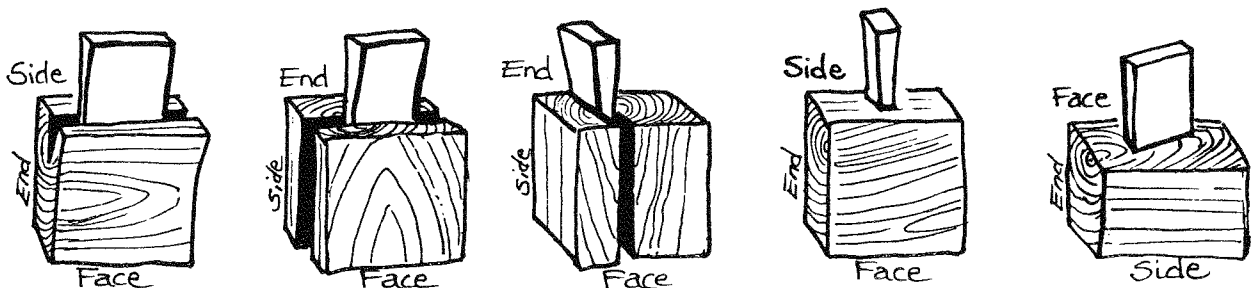
In many tree species the annual growth ring has an obvious difference between spring and summer growth. **Springwood** growth is rapid, with larger, thinner-walled, weaker cells. **Summerwood** growth is slower, denser, stronger and usually darker.

This annual "sandwich" makes wood unusually strong for its weight. The kind of strength varies with the type of grain though. Side or edge grain is stiff and strong. End grain has very strong resistance to impact. Face grain is springy and resilient. The grain around a knot is confused, dense and very tough.



Grain can be both wood's **strength** and its **weakness**. This is due to the different characteristics of springwood and summerwood. Because of these differences, wood must be used carefully to prevent failure.

Light spring growth is weak. It can separate if too great a force is applied against it. This force might be a wedge or a cutting tool. When the strain is too great, the wood will split along the grain. Wood is prone to splitting on the end grain, creating slivers and small pieces.



## Cutting Comments

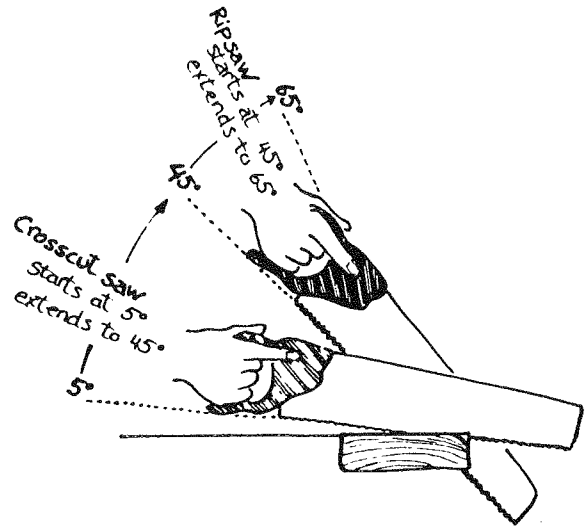
### GETTING A GRIP ON TEETH

If you look at the teeth of a saw, you will see that the teeth are bent alternately, right and left. The amount which these lean out is called the **set**. The teeth cutting through the wood makes a groove called the **kerf**. Having a kerf that's wider than the blade prevents the blade from sticking. Between the sharp cutting edges of the teeth are hollow spaces called **gullets**. The gullets' job is to carry out the wood fibres the teeth have cut.



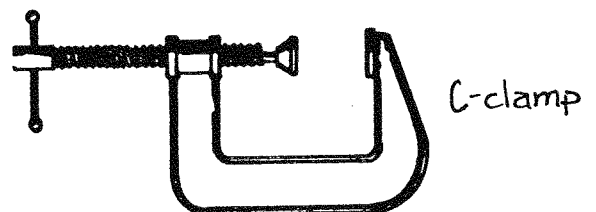
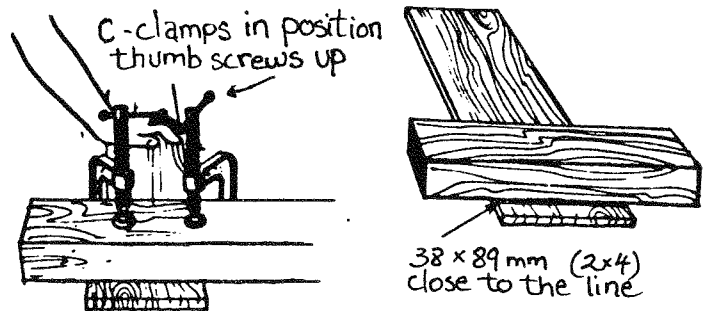
As you might guess the major difference between one saw and another comes down to a matter of teeth. The crosscut saw for instance, has teeth that are sharpened on an angle to the blade. This makes them act more like knives. The teeth on a rip saw are sharpened at right angles to the blade, are less frequent, and have less set. Sharpened as they are, these teeth act more like chisels. The angle of sawing with a rip saw is different too. While the angle of

approach with a crosscut saw is around 45 degrees, it is closer to 65 degrees with a rip saw.



### SAWING WITH A GUIDE

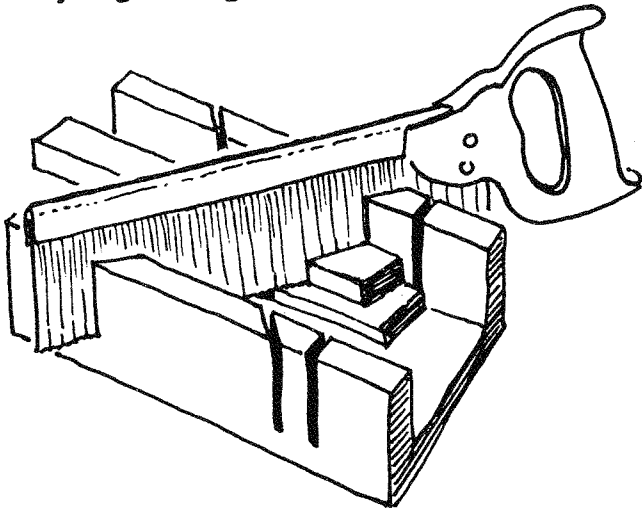
When it is important to have a square cut, you might want to try sawing with a guide clamped in place. You begin by clamping the workpiece in place as usual. A second piece of wood, one with a good straight edge is placed on, but not covering the cut line. This is secured with two C-clamps (This is a great time to have a helper holding things in place.) Just before the clamps are tightened finally, you might need to adjust the guide's placement with light taps of the hammer. Begin sawing as usual, following the edge of your guide.



- HINTS:**
- Clamps can dent the workpiece. Put thin scraps of wood between the workpiece and the clamp.
  - If the guide is to help you cut accurately, it is critical that it is placed accurately.

### SAWING AIDS: USING A MITRE BOX

A mitre box is used when we wish to cut accurate angles. The mitre box is a simple wooden box with precut slots that guide the saw. Normally it is used in combination with a backsaw. This saw's teeth are numerous, and fine, with little set. This gives a good, smooth edge. The typical angles cut are 45 or 90 degrees. Some mitre boxes can be adjusted to any angle though.

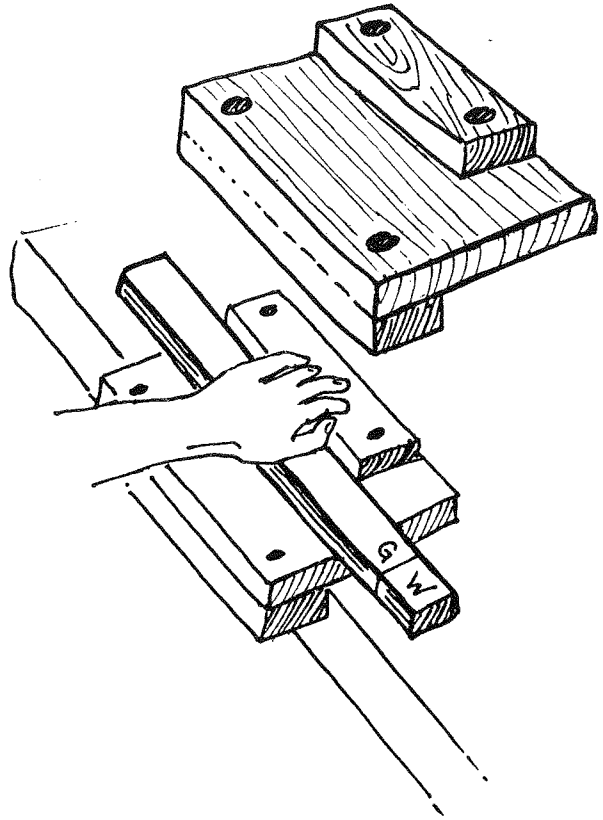


The mitre box can be clamped into place. Often it has one lower "lip" which acts to catch the edge of your workbench. This lip holds against the push of the saw. The workpiece is then secured against the back wall of the box with either your hand or a clamp. Be sure the cutline is lined up with the right slot. Guide the backsaw through the slot, and cut through the piece.

- HINT:**
- A piece of thin scrap under the workpiece prevents the mitre box from being scarred.

### SAWING AIDS: A BENCH HOOK

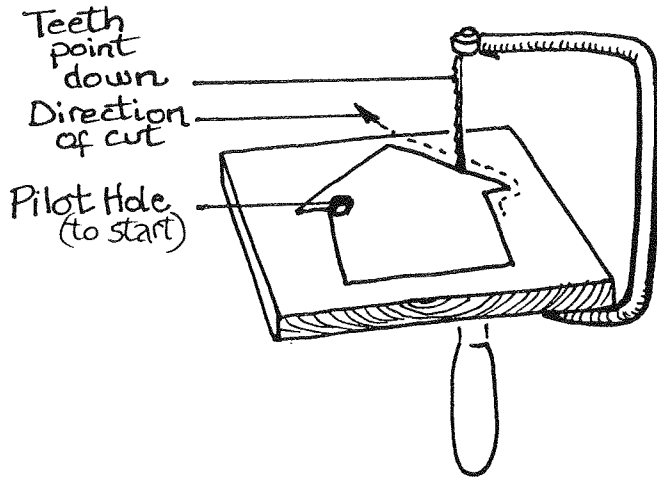
This handy little tool can help hold small pieces for cutting. It can be put together easily with some scrap wood. The lower lip holds the hook against the edge of the workbench. The workpiece is held firmly against the upper lip. The upper lip is shorter than the length of the hook. This allows you to saw on the hook, rather than off its edge.



### MAKING AN INTERIOR CUT WITH A COPING SAW

Sometimes the piece of wood to be cut out is inside a "frame" of wood. Do this using a coping saw. Start by drilling a pilot hole on the waste side of the line. The hole must be large enough to easily fit the coping saw's blade through. The blade is loosened, and one end is detached from its holder. This allows the blade to be threaded through the hole. After properly tightening up the blade, sawing can proceed as usual. The blade is disconnected again to free the saw.

- HINT: • The pilot hole is often placed at a corner where it can save you trying to make a sharp turn.



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## **BEFORE THE NEXT MEETING**

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- For the Roll Call of the next meeting, look again at the objects in your wood diary or around your home. This time make note of the shapes of the wood in these pieces. Describe in words, illustrate with drawings, or bring in samples of four or five different shapes where the wood's original square or rectangular shape has been altered. Think about how these shapes might have been made, or why they are the shape they are.
- Tools and Materials: If you have them, bring in safety glasses or goggles, a hammer, nails (a variety of types and lengths), an electric drill and bits and pieces for your project or for practice to nail or drill.



# Putting It Together I

## ROLL CALL

Illustrate, describe or show the shapes you found where wood's original square or rectangular form has been altered to create new shapes. Do you have ideas of how they were formed? (Consider options such as: being cut in a curve or an angle, turned into a round shape, carved, shaped into a profile with a spinning cutter.)

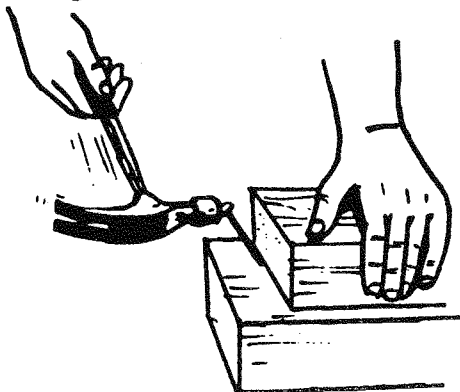
## *Joining Wood*

### HAMMER SKILLS

#### STRAIGHTENING NAILS OUT

Nails can bend, so it is helpful to know how to straighten them, to finish driving them in.

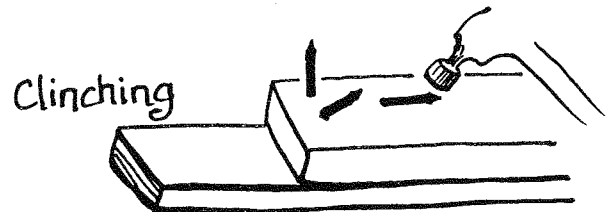
- If only a little of the nail is still out, just hit it on the leaning side until it is straight.
- If most of the nail is still exposed, set a block of wood opposite the leaning nail where it will touch the bottom edge of the nail. This provides something to hit against. Once again hit the nail on the leaning side until it's straight.



- Sometimes it is best to pull out a badly bent nail, and start again.

### CLINCHING NAILS

Sometimes extra long nails are used for a job. This may be done on purpose for the extra strength **clinching** lends to a joint. Clinching a nail means hammering the extra length over at a right angle to the way it came through the boards. This is most commonly used when two boards lap each other on their flat sides. For instance, where two boards are being nailed together to make a thicker beam or post, or when single boards are nailed together with "Z" shaped battens to make a plank door.



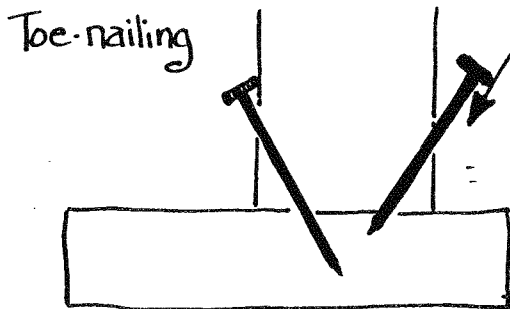
To do this:

- Put the pieces to be joined on a surface that can be dented, like scrap wood
- Drive the nails until the heads are flush on top
- Turn the pieces over, and drive the nails at right angles until they are pressed into the surface of the board.

## TOE-NAILING

This is used in construction carpentry, when two boards make a "T" joint. Do this by:

- Starting nails at a 45 degree angle on the upright board of the "T"
- These should be placed on both sides of this upright (one nail pushes against the other)
- Hammer the nails (often four) until the points just show
- Line up the two pieces and begin hammering the nails through to the other board
- The upright board tends to creep to one side, so offset this effect by hammering the opposite nail and return the upright to its correct position.



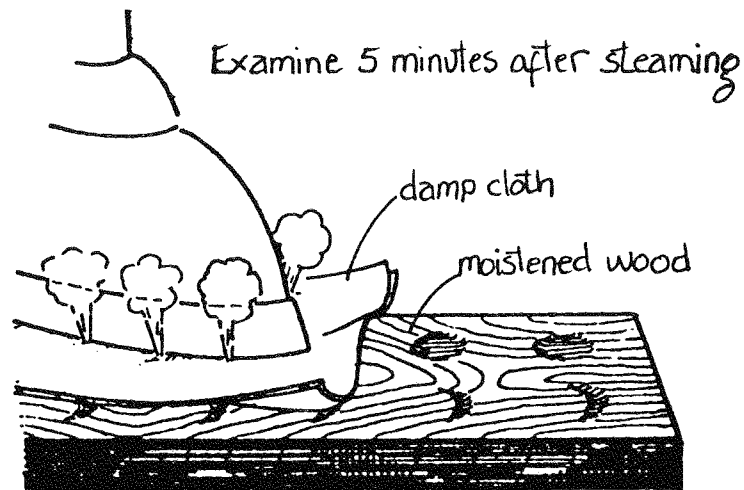
## REMOVING DENTS

Sometimes when using a hammer you have to deal with dents you accidentally made, if you want the wood to finish up nicely. You can use moisture and/or heat to 'swell' up the dented tissue, and reduce or completely remove dents.

To do this, dip a finger into some water and transfer a small amount by touching the dent. Watch the water, and if it has disappeared in

less than two minutes then add some more. After five minutes, use a cloth to wipe up the excess moisture.

If this alone has not restored the dented fibres to their original shape, use a hot iron to "steam" the dent. After allowing the water to soak in for about two minutes, place several thicknesses of damp cloth over the dent, and heat with the tip of the iron for 15 to 20 seconds. Let the spot 'rest' for about five minutes and then check it again.



- HINTS:
- You may have to repeat the process a few times to get rid of very bad dents.
  - Keep the cloths damp, or the hot iron could burn the wood.
  - This procedure **does not** work with punctures.
  - Prolonged wetness can discolour wood. Dry off excess moisture with a cloth after five minutes.
  - Wetting and steaming can cause glue failure in certain plywoods.
  - Let the wood dry for 24 to 48 hours before the final sanding.

**CAUTION:**

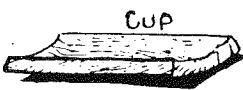
- Keep in mind the safety precautions that go along with any electrical tool.
- Be extra careful when working with a hot iron, so you do not burn yourself.

## *Facts And Figures*

### **WOOD MOVEMENT - SHRINKING**

Although the lumber is no longer alive, it is still changing. With few exceptions, the **green** (fresh) lumber must be dried before it can be worked with. It is during this drying that the most noticeable change – shrinkage – occurs.

Drying is done naturally by air, or in large "ovens" called **kilns**. The wood cells shrink as the moisture evaporates. As a result, the board is no longer the same dimensions it was named by when first cut. These dimensions (ie. 1 x 4", 2 x 4" etc.) are the lumber's **nominal size**.



This shrinking can result in several **defects**, or faults, which can limit the usability and value of the board. Sometimes lumber is graded again after drying, if it's prone to these defects. Some include a **cup** across the width of the board, **bow** or **twist** along its length, and **winds** in both directions. These can be minimized by the way the board is cut (i.e. quarter sawn), and by the speed of drying (i.e. slowly).

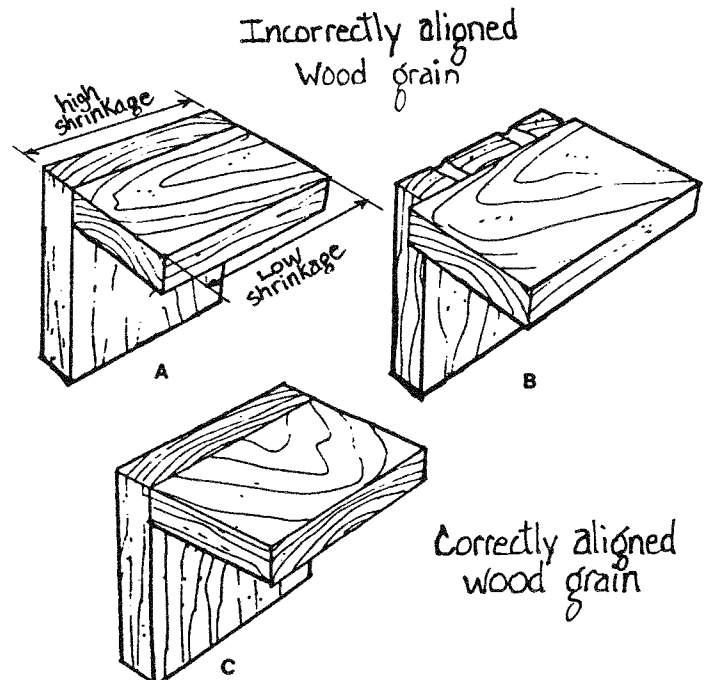
The dimensions of the board may also be reduced by an operation called **planing**. During planing a small amount of the board's surface is shaved off to produce a smooth, **dressed** finish for fine work. Planing is done after the board is dried. One reason it is done is to eliminate the warping that has occurred.

### **SHRINKING AND SWELLING**

#### **CONSTANT CHANGE**

Even after the initial drying, the moisture content of the board continues to change. It increases or decreases, according to the relative humidity of the surrounding air. Wood for finish interior work or furniture is often dried down more after outside storage. This final drying takes the wood from twelve to fifteen percent to about six or eight percent. This is normally done just before it is used. Drying at this final stage will reduce the amount of change in the finished piece.

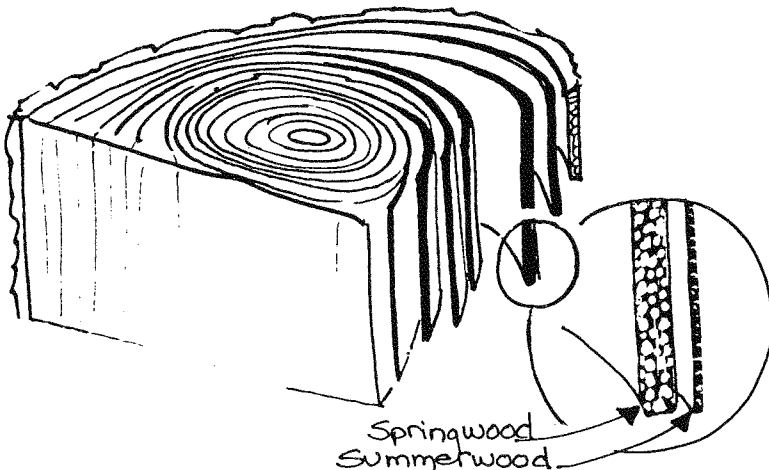
Woodworkers must consider the changing nature of the wood, and design with it in mind. If they do not, warping or splitting can occur. This can happen when one piece of "moving" wood is fixed securely to a piece that isn't shifting in the same direction.



## VARIATIONS IN MOVEMENT

The amount a board moves, whether shrinking or expanding, varies with each direction. Along the length of a board it changes very little. Movement in the other two directions is greater. Tangentially, the wood shrinks two and a half times more than radially. Because of this, the movement of a given board's thickness and width will vary depending on the cutting method, ie. whether the board is flat grained or edge grained. To understand why this is so, think back to the "sandwich" pattern of wood cells.

Remember that the cells of the **springwood** and **summerwood** differ in their size and wall thickness. Generally, the cells of springwood are larger and have thinner walls. This means they lose moisture much faster than the dense, thick-walled cells of summerwood. Because these layers alternate, this puts strange stresses on the board. The springwood contracts along the grain sideways as it dries. Because it is bonded tightly to the summerwood it can deform the board.



Wood that you purchase at the lumberyard is usually dry enough to be used outdoors as is. However, before putting it to inside use, let the lumber dry in a heated room of the building. In winter this may take two or three weeks. By that time the wood will have adjusted to the

humidity in its surroundings, and will not alter substantially in the future. (The dimensions of products such as plywood and particleboard etc. also change in length, width, and thickness with moisture changes. These are far less than the changes seen in lumber's width.)

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## BEFORE THE NEXT MEETING

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- For the Roll Call of the next meeting think about how the demand for wood affected how this country was settled.
- Tools and Materials: If you have them, bring goggles or glasses, carpenter's glue, C-clamps, pipe clamps, scratch awl, square, pencil, electric drill and bits, screws (various sizes, around 35-44mm long, 1 3/8 to 1 3/4") and some scrap or project pieces you want to join together. If you are practicing dowelling also, bring dowels, drill bits to fit dowels, masking tape, jack or utility knife and hammer or rubber mallet.

# Putting It Together II

## ROLL CALL

Wood was one of the resources that attracted explorers and settlers to Canada. How was wood used, and what role did it play in the settling of this country?

## *Historical Look At Screws*

Screws have been around since 250 B.C. when Archimedes first thought of the idea. However, screws have not been commonly available until the machines to cut threads easily were developed. That was not until the 1850s. In Dundas, Ontario, a man named J.P. Billington produced the first Canadian screws in December of 1864 after developing machinery for heading, slotting, turning and threading. He and his partner, R. Forsyth, produced farm tools and sewing machines. Billington saw great need and potential for these fasteners.

## *Types of Glue*

These glues must be used with more caution, but they have greater weather resistance, and offer other valuable characteristics.

### PLASTIC RESIN GLUE (urea formaldehyde)

- It must be mixed with water before use.
- Use only at temperatures over 21°C (70°F).
- It has better moisture and heat resistance than white or yellow glue.
- The glue line does not stretch (suitable for gluing up turning blocks).

### CAUTION:

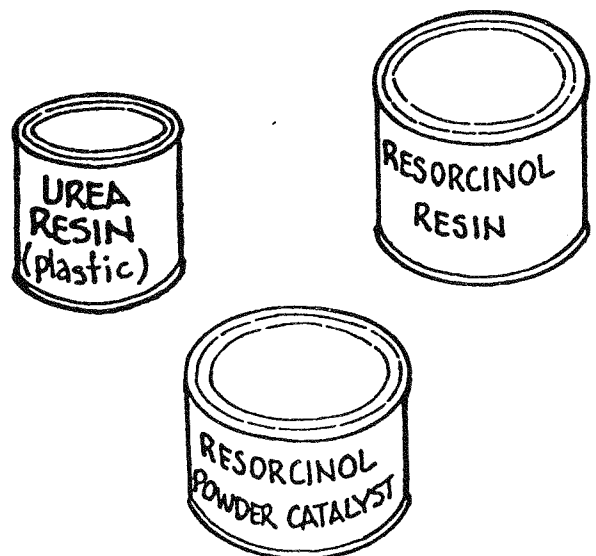
- Use in a well ventilated area only and avoid skin contact.
- When used within the closed environment of the home, it can cause problems for some people, even when it is dry.

### RESORCINOL RESIN GLUE

- This comes in two parts, a liquid resin and a powder catalyst, which are mixed at time of use.
- It is waterproof, dark red in colour and can only be used at temperatures above 21°C (70°F).

### CAUTION:

- Always use in a well ventilated area only and avoid skin contact by using latex gloves.

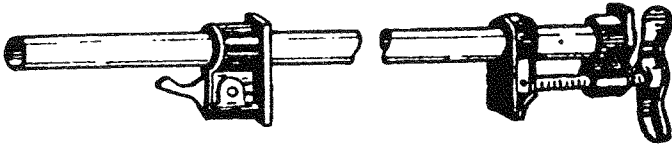


## Gluing Wide Boards

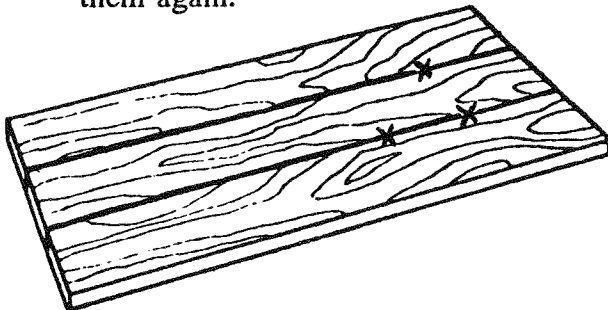
As with any gluing operation, prepare in advance. Boards must have good, smooth edges. Clamps must be at hand, and checked to ensure they can spread enough to fit.

AIM: • To learn about gluing up wider boards.

NEED: • Three pieces of scrap wood, about 2.5 x 3 x 30cm (1 x 2 x 12").  
• Three pipe clamps.  
• Glue, preferably white or yellow.  
• A spreader for the glue.

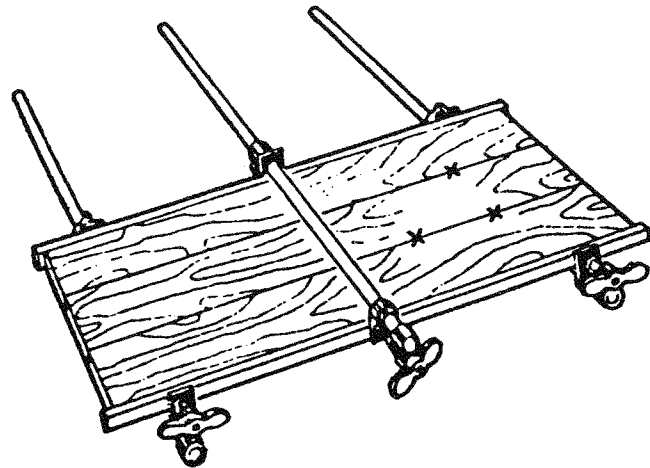


DO: • Prepare the lumber (three pieces of wood). You need two boards with one long edge that is flat and square, and one board for the middle with both long edges being flat and square.  
• Arrange pieces on flat surface so they fit.  
• Mark the pieces so you can align them again.



• Lay two pipe clamps on your work surface.  
• Position the boards on top and adjust clamps to fit boards.

- Remove clamps.
- Apply a thin layer of glue on each surface and spread evenly.
- Replace boards on clamps.
- Lightly tighten the two clamps on the ends.
- Check the alignment of the boards, and tighten a third clamp on the topside.
- Tighten all three clamps again and check alignment and the surface for evenness.
- Remove excess glue.
- Allow to dry for the time suggested on the glue container.



- HINTS: • A narrow edge strip between the wood and the clamps prevents denting.  
• Warping and cupping will be reduced if the boards are placed so that annual rings on the end grain go in opposite directions, i.e. one curving up, the next curving down.



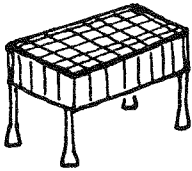
Layout of end grain to reduce warping.

## Facts and Figures

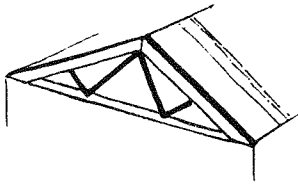
### QUALITIES OF WOODS

Each of the many woods suitable for woodworking has its own set of qualities and workability. This is why a small boat might once have been made from as many as seven different woods. It may have had cedar planking, locust oarlocks, an oak keel, ash oars and more. The unique properties of each made it better for one purpose than any other wood.

When you try to decide which wood is right for the job, look at many different factors.



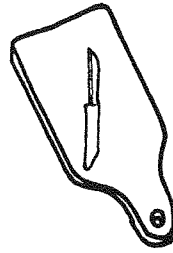
**STRENGTH:** This is essential for certain uses such as butcher block tables (maple) and structural elements (fir, oak).



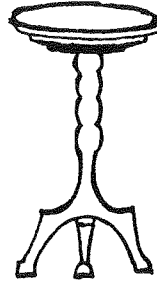
**STABILITY:** It is important that a wood is not prone to unexpected failure or shifting when it is used as part of something larger, e.g. a house. Mahogany, fir and redwood all have excellent stability.



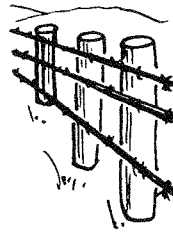
**WORKABILITY:** This can include everything from how well the wood seasons, to workable moisture levels, to how easy it is to work with hand and machine tools. Basswood is soft, and fine grained; this makes it excellent for carving. The firs (split easily and are difficult to work with hand tools), and hickory and sycamore (are difficult to season without warpage), have poor workability.



**HARDNESS:** The hardness of a wood will enable it to stand up to tough use (e.g. floors or cutting board) without a lot of wear and tear. Maple, black cherry, oak and hickory are very hard woods.



**FINISH:** For fine cabinetry and furniture you generally want a very smooth lumber that can take paint or clear finish well. Some woods are not smooth because they have large pores (elm, hickory and oak) which have to be filled for a good finish. Some woods have a rough or fuzzy finish (fir). Some do not take paint well (spruce).



**LONGEVITY:** In certain circumstances, usually for outside use, look for woods which are long-lived. Choose cedar for fenceposts or locust for the structure of a greenhouse for this reason.

### QUALITIES OF SOME SPECIES

There are other characteristics by which woods are chosen for certain jobs. Some woods bend readily without snapping. They are used for things like bows or curved chair backs. Some woods are oily and withstand weather well. This makes woods like teak excellent for use in outdoor furniture or boats. Some have a tight grain making them hygienic. Others have no detectable smell or taste, making them useable for food handling. Others have exceptional colour or figure. These highly prized woods are most often used in veneer production.

**ASH:** The wood of ash is heavy, strong, stiff and yet has excellent bending qualities and shock resistance. It is widely used for bats, oars, handles for shovels and forks etc., and the curved parts of chairs.

**BEECH:** This is another heavy wood high in strength and shock resistance. Being very fine-grained it is clean and hygienic. Beech is used for breadboards, rolling pins, spoons and kitchen furniture. Its fineness also make it a good choice for turned handles of tools.

**BIRCH:** Most of the birch used is yellow birch. It is heavy, very strong, hard and close-grained. Birch is often used for veneers. Because of its durability and strength, it sees much use in cupboards and school seats. River birch logs will keep for a long time if immersed in water. Several logs buried beneath the surface of Lake Superior for sixty years were located and used to produce very fine veneer! UNBELIEVABLE! There was only slight loss in the length of the logs.

**OAK (WHITE):** This is one of the hardest, heaviest and strongest of all the oaks. It is easy to work with and can take quite a good finish. Much of it is used for veneer, for furniture and for panelling. Because its pores are filled with tyloses, liquids can not penetrate the pores. This means white oak is commonly used for barrels for liquor and other containers for liquids.

**WALNUT:** After it is seasoned, walnut is a very stable wood. In most respects it is excellent to work with and takes a finish well. Its outstanding figure patterns and colour mean it is frequently selected for veneer. Walnut is often the wood of choice for fine furniture. Because it can help take up the recoil of a shot better than any other wood, it has long been used for gunstocks.

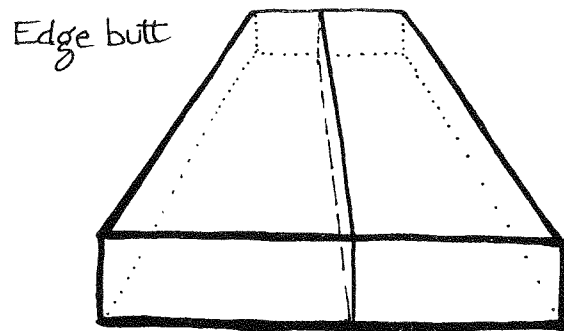
## Joining Wood

### FASTENERS AND JOINTS

Some methods of joining have some drawbacks.

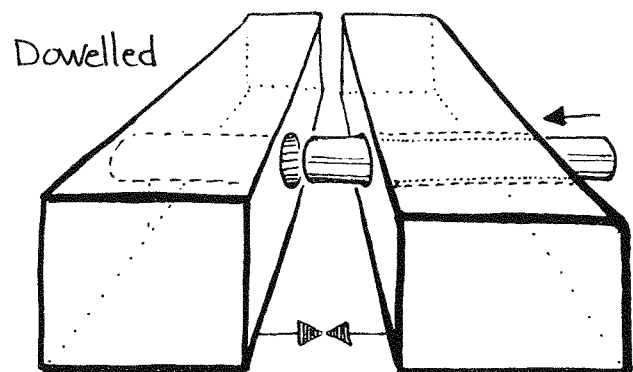
**NAILS:** These are not good at resisting forces pulling them straight out.

**GLUE:** Edge grain to edge grain gluing creates a bond as strong as the wood itself. However, gluing end grain to side grain is not strong enough to work on its own.



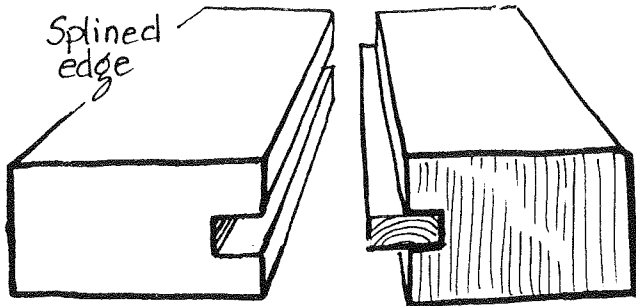
What else can be used?

**DOWELS:** These cylinders of wood were known as **tree-nails** in the past. They enable you to join pieces of wood together using other bits of wood. Some craftspeople like the "rightness" of this idea. Dowels made just for gluing are usually grooved. This allows the glue to flow and the pressure to equalize.

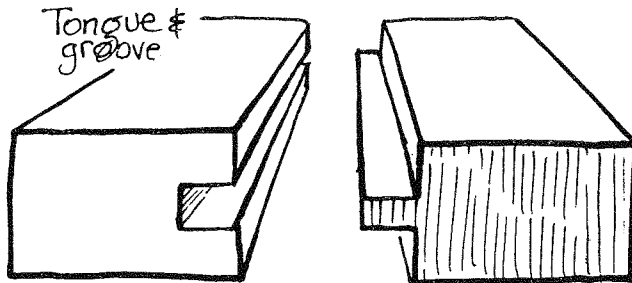




**SPLINES:** These are another type of wooden fastener but they are long, thin and rectangular in cross section. They are fitted into specially made grooves.



**JOINTS:** By simply changing the way one piece fits with another, the strength of a joint is increased. In some cases the joint design can be so strong that glue is not necessary! When neatly done, joints such as dovetails or splines can add an attractive element to the design of an object. In order for joints to work properly they **must** fit very well.



## DOWELLING

The use of dowels and the electric drill can greatly increase the strength of joints. Dowels are often used with butt, lap and mortise and tenon joints. Once the pieces of a joint are properly lined up, a common hole is drilled through both. A wooden pin is fitted snugly into place, binding the one piece to another.

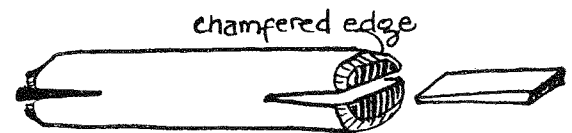
## HOW TO DOWEL

**AIM:**

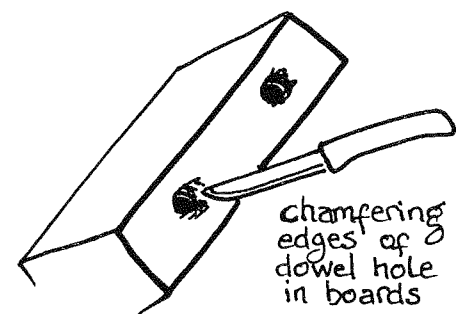
- To learn how to use dowels to help hold pieces of wood together.

- NEED:**
- Two pieces prepared for joining.
  - Glue, white or carpenter's.
  - 10 cm (4") length of 9.5 mm (3/8") dowelling.
  - Jack knife.
  - Electric drill, 9.5 mm (3/8") bit.
  - C-clamp.
  - Handsaw.
  - Masking tape.
  - Square, pencil and awl.
  - Rubber mallet or hammer.

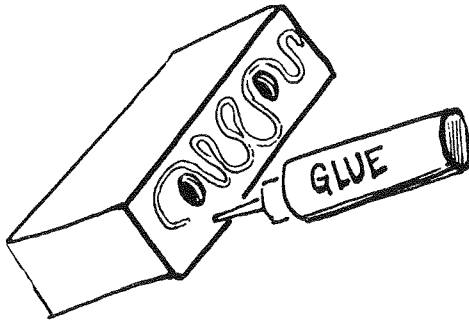
- DO:**
- Align the pieces to be joined and clamp together.
  - Mark holes to be drilled and use the awl to make a centre hole.
  - Calculate the length of dowel required, ie. 4 cm (1½") and cut pieces to length.
  - Trim (**chamfer**) the sharp edge of the dowel's end with the knife.



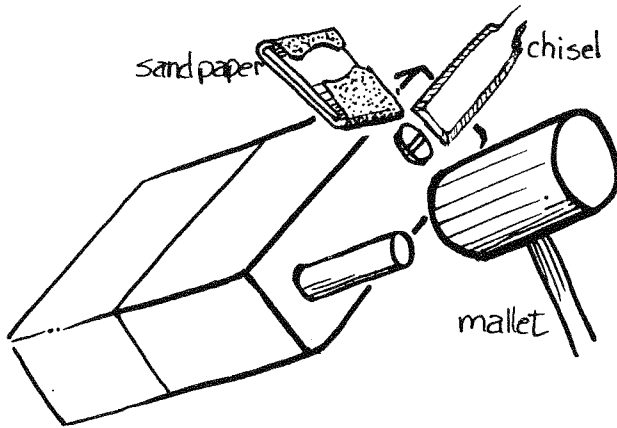
- Measure the same length, ie. 4 cm, on the drill bit's end, and mark with a band of masking tape to act as a depth indicator.
- Holding the drill squarely in place, drill to correct depth.
- After drilling holes, unclamp the pieces, and slightly trim the interior edges of the holes with a knife.



- Spread glue on the dowels, the surface of the holes and the faces of the board.



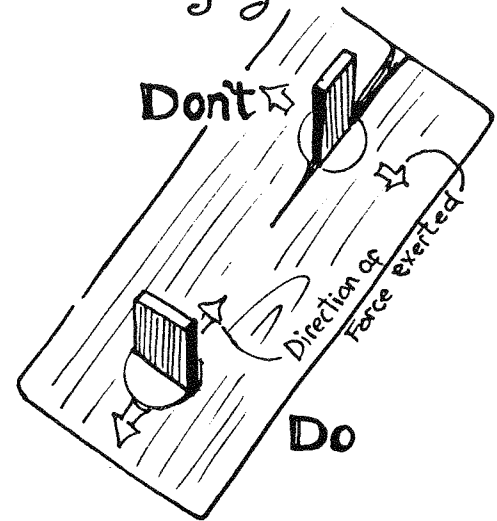
- Realign the pieces and reclamp.
- With a hammer or rubber mallet, gently tap the dowels into place. Use a flat piece of scrap wood between mallet and dowel to ensure the dowel is flush with wood's surface.



- HINTS:
- Dowels can be cut **slightly** shorter than depth drilled to avoid them sitting higher than the wood's surface.
  - If the dowel is longer, it can be trimmed with a chisel and sanded smooth.
  - When driving the dowel in, it is important not to stop. If you do, the dowel may seize in the hole and refuse to go further.

- Wedges can be inserted into slots on the end of a dowel. These give the dowels even more holding power. You must be careful about the direction of the wedge. Make sure it presses against the end grain, not between the grain. The wedge's power can be great enough to split the grain.

### Wedging Dowels



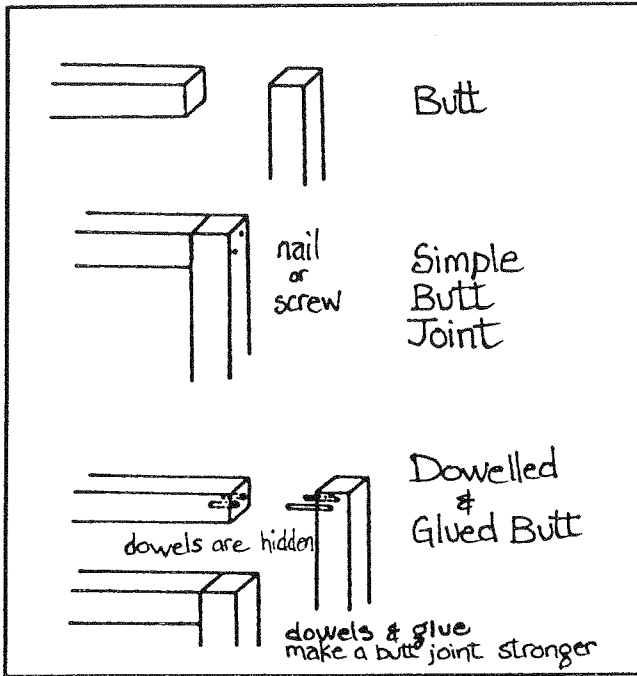
- Dowels are also used in joints where they go unseen. Marking these requires extra care because the matching holes are drilled separately. Dowelling points or dowelling jigs help to correctly locate the holes on the matching pieces.

## Types Of Joints

### BUTT

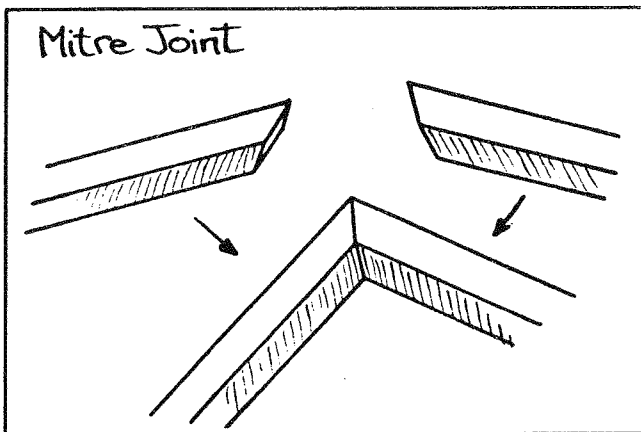
The butt joint is the most basic joint. As its name suggests, it is made by one board simply butting up to another. It is used for the corners of boxes and crates. The matching ends and edges of the boards must be square. As the pieces are put together, use a square to ensure a

90 degree angle. Nails, dowels, screws and/or glue can all make butt joints stronger.



### MITRE

The mitre joint is a butt joint where the two boards meet at an angle, usually 45 degrees. These are commonly used for picture frames. It is critical that the measurements and mitred cuts are exact. The use of a mitre box helps ensure a proper cut. Glue has little holding power on end grain, so nails, screw, dowels or corrugated fasteners are also used.



### LAP

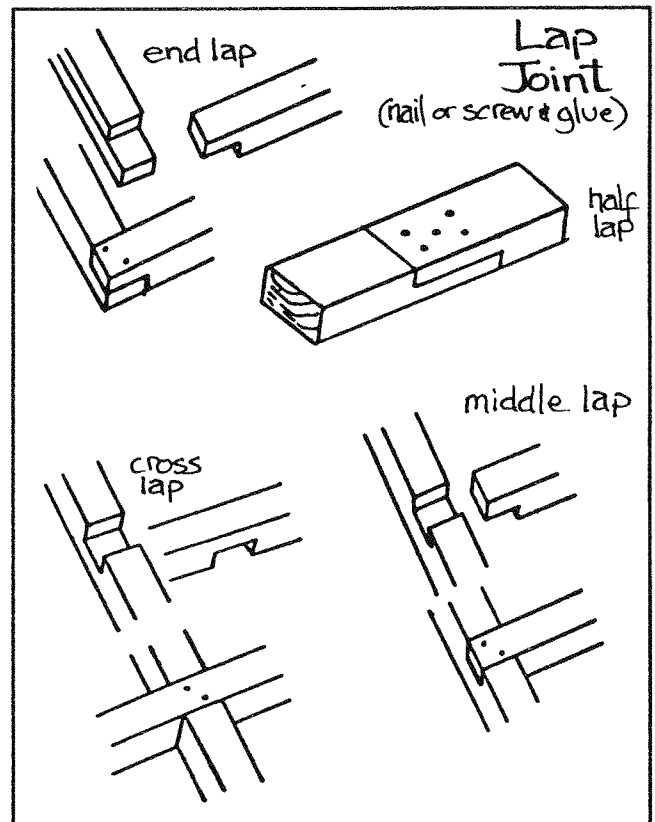
There are several types of lap joints, depending on their position on the work. In each case, both members of the joint are stepped to meet each other. Generally, half the board's thickness has been removed from the bottom of the one board and on the top of the other.

The **END** or **CORNER LAP** is used in corner construction. It makes a much stronger joint than a butt joint.

The **MIDDLE LAP** joint is used where one member joins another at right angles. The one member ends at the joint.

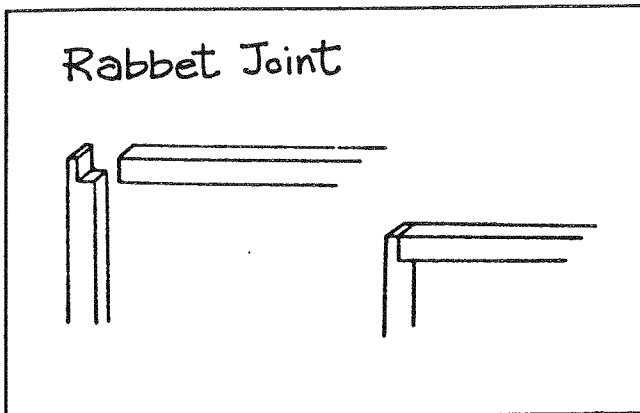
A **HALF LAP** joint is used to join ends of two pieces, making a longer piece.

The **CROSS LAP** joint is used when two pieces meet at right angles, and both carry through to form a cross.



## RABBET

This is basically a butt joint where one piece fits into a step made in the adjoining piece. The rabbet joint is often used in drawer construction. It is a little stronger because the one piece is not able to open or twist as it might in a butt joint.



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## BEFORE THE NEXT MEETING

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- You might wish to try to drill other holes: larger and smaller, to a certain depth, or lining up two pieces to be joined and then drilling for dowels or screws.
- Tools and Materials: If you have them bring goggles, sandpaper (80 to 180 grit), a sanding block, clean cloths, penetrating oil finish, paint brush, rubber gloves, steel wool (# 0000), electric sander, sheets of sandpaper and pieces of wood. Bring markers, woodburning tool, acrylic paint and samples of decorative painting.

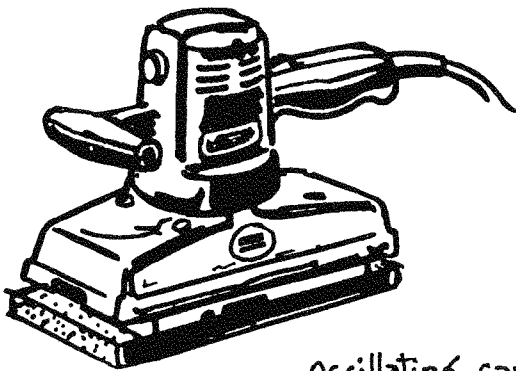
# Finishing Touches

## ROLL CALL

Describe, name or draw the different types of joints you found in wooden items in your home. Were there some joints that were hidden?

## The Electric Sander

The electric sander can speed up a tedious job. It requires careful control because of this speed. Electric sanders are great for sanding large cases like a dresser, or big surfaces like a table top. If you want to sand smaller pieces, be sure to clamp them securely before you begin.

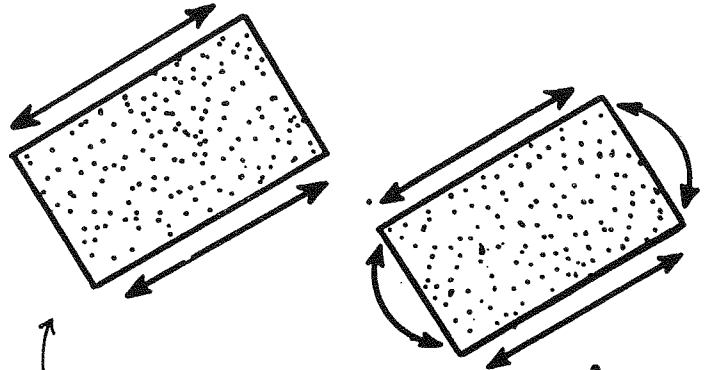


oscillating sander

## TYPES OF SANDERS

There are two basic types of electric sanders: straight and orbital. Some machines have a switch that let you change from one motion to the other. A straight sander moves back and forth, like your hand would. This is slow, but unlikely to cause damage. The orbital sander moves in a circular motion, up to 20,000 orbits per minute. This is a lot of sanding power and

speed. However, this type of motion can leave swirled scratches.



Straight-line, best for fine sanding  
Orbital, best for rough fast sanding

## USING THE ELECTRIC SANDER

The electric sander uses strips of the standard sheet of paper, generally a 1/2, 1/3 or 1/4 of the sheet. The paper is held by a clamp that snaps into place, or a ridged cylinder that is turned.

**REMEMBER:** Since this is an electrical tool, the standard safety concerns for such must be considered.

With both types of sanders it is not wise to "start and park." It is better to start the sander above the work, land gently and move continuously along with the grain. The orbital sander should move forward at about 25mm (1") per second, to reduce the marks it leaves. With either sander make overlapping, parallel strokes up and down the piece as you work. When finishing, lift the machine off, then stop it.

## ***Facts And Figures***

### **WOOD'S FUTURE ROLE**

The modern world is changing rapidly, yet some old things still seem to have a place. Wood appears to be one of those. Although large timber-frame structures are now rarely built, most individual homes are still framed in wood. Within the home, many furnishings are still wood. These range from brooms, mixing spoons and rolling pins; to tables, chairs and cabinets; to floors, panelling and trim. Paper remains one of our greatest uses of wood, despite the computer.

But man is using wood at an alarming rate. The rain forest is disappearing at the rate of a football field per second. This means forested areas the size of the Netherlands and Switzerland put together are lost each year.

Realize that the true cost of your lumber is much more than the \$8.75 you hand over at the lumber yard. The earth's ability to moderate the climate is already seriously weakened. All life the rainforest once sustained is now threatened. Insects, birds and animals must seek a different home. Tribes living deep in the rainforest face death and extinction. So too do thousands of plants. It is estimated that some 20,000 plants used as healing agents will be extinct by the year 2000. And this is only one part of the picture.

As wood resources diminish, we have come to value wood more. Wooden articles have warmth and individuality. These characteristics are a welcomed change from the "coldness" and sameness of plastic or metal. Wood compares favourably to plastics and metals in other ways.

Wood is capable of renewing itself within a generation. Oil for plastics, or ores for metals can not do this. The processing required to

turn wood into a usable material is fairly simple and consumes little energy compared to those for plastic or metal. A lot of the waste created during the processing of wood is put to use in other products, such a particle board. While the processing of wood is not without its pollutants, the by-products of the plastic and metal industries that are flushed or dumped also cause some very serious problems. When the usable life of the wooden article is over, it will at least decompose. This is not the case with metals or most plastics. Generally speaking, most wooden and metal 'garbage' has some real recycling options, unlike most plastic 'garbage.'



Regenerating  
resource

So, when you consider other options like plastic and metal, wood is still one of your best options. How then do you deal with trying to reduce the amount of wood for use? Only by looking after what you already have, and limiting what you need, can you slow down this rate. We all must learn to use wood wisely. Here are some things to think about.

### **LOOKING AFTER**

By looking after the wooden articles you own, you can make them last longer.

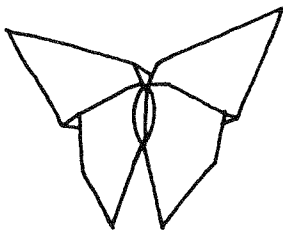
- Don't leave your hockey stick on the drive where it will be run over and you will need another one.

- Don't leave books or notebooks on the picnic table to be ruined by dew or rain so that they have to be replaced.
- Protect the sensitive finish of tables from hot or cold drinks or food, by using trivets or coasters.
- Don't hit the ball so hard that you break your bat (NOT!).

## REUSE

By reusing items you can reduce the demands for more wood. These ideas may seem "small," but together they make a big difference.

- Salvage wood from one source for use in another project. Perhaps your old unused tree house can provide material for that go-cart you want to build.
- Give some antique furniture a second life, rather than buying something new.
- Turn used paper from school to scrap. Those pages having one bare side can be cut into quarters and stapled together to become note pads. Pages used on both sides can go into a pile for origami or other craft uses. Fine paper you cannot use again can at least be recycled.

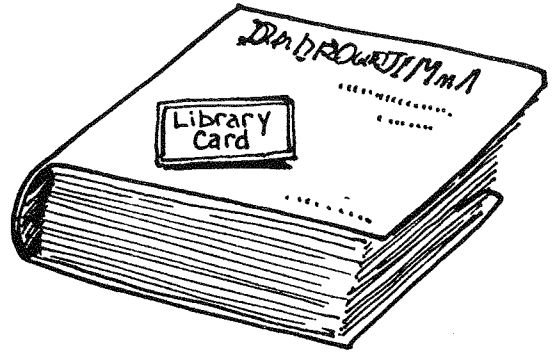


Origami

## REDUCING

By re-thinking the uses of wood you see as "necessary," you can start reducing your demand.

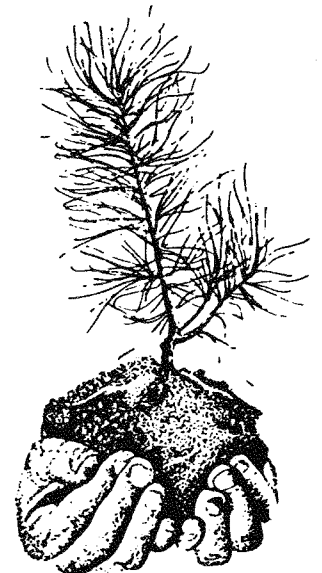
- If you heat with wood, put a sweater on instead of another log.
- Borrow books from the library or a friend, instead of buying them. Perhaps you have some good ones you do not use any more that you could donate, or lend.
- Plan and design projects so you minimize the amount of waste.
- Avoid buying "throwaway" wood, whether it's poorly made products or wasteful packaging.



## POSITIVE ACTION

By helping in a positive way you can start shifting the balance.

- Volunteer for tree planting programs with school, 4-H or local conservation authority efforts.



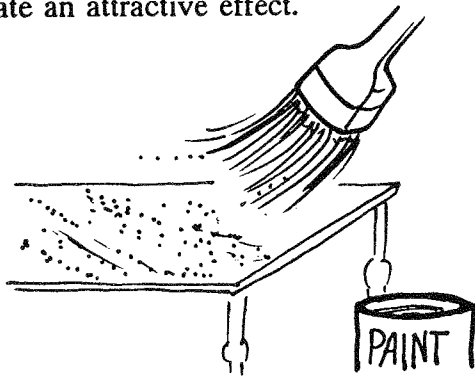
- Raise or donate money to programs that seek to preserve or replant the forests.

## *Other Decorative Techniques*

### **PAINT MAGIC**

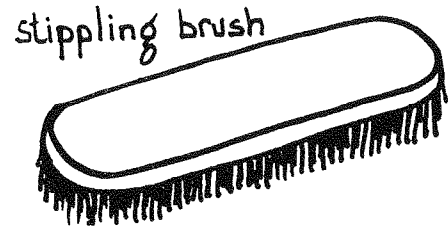
Paint itself can be used in a number of decorative ways. You can achieve different effects by the way you apply the paint, or by the way you treat the paint once it's applied. Any of these methods are used after a base coat, often a light colour, is on and dry. The effect can be increased by using more than one colour.

Splattering is a simple way of applying paint in a unique way. Have your work space protected by a plastic drop sheet or by newspapers. Splattering is done by holding a loaded paint brush (just wet the bristles to a depth of 12mm) about 4-5 cm over an article, and jolting the brush against a piece of wood. Paint can also be applied with a marine sponge. By pouncing the loaded sponge in different directions, you create an attractive effect.



There are many different ways of altering the paint once it is on. Most are forms of **stippling**. You can use a marine sponge, a piece of foam, a brush (similar to a shoe brush), or even a paper towel with this technique. Each is dabbed repeatedly into the paint in random directions. Each material produces a slightly different effect. A similar technique, **rag rolling**, alters the paint as a

crumpled rag is rolled through it. You can even drag special tools called **combs** (plastic forks can produce a similar effect) through paint to create fake graining.



### **PERMANENT MARKERS**

Permanent markers can be used to provide bright colour in a fast, easy way. They act more like stain, since the grain still shows through. They can be put to good use on light woods, particularly in simple articles where a coloured design becomes the main feature.

The wood is sanded. A pattern is copied onto the wood. On the back side or a scrap, test pens to see if they spread very much. If they do, the wood must be sealed lightly with acrylic sealer (spray can is simplest). The pattern is outlined with a black marker. Then colour in areas as you wish. The marker is "fixed" with two or three coats of acrylic sealer. The piece is then protected with polyurethane varnish.

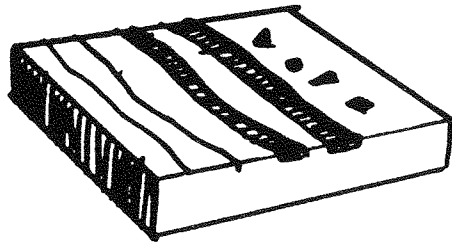
### **FOLK ART PAINTING**

Folk art painting is distinguished by particular brush strokes, the use of multiple colours for shading and frequent use of flowers, fruits and borders in the designs. There are lots of books available showing the brushstrokes and designs.

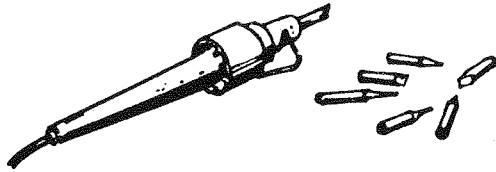


## WOOD BURNING

This technique relies on a small tool which holds different tips that are electrically heated. By varying the slope and speed of travel, the tips create different effects as they burn the wood. Wood burning can add special details and interest to pieces. It is best used on smaller articles, generally those for indoor use.



Burned marks & lines




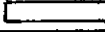


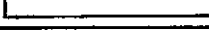





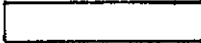








Wood burning tool

**HOLE SIZE RECOMMENDED FOR WOOD SCREWS**

Screw Gauge Number	Pilot Holes				Shank Holes	
	Hardwood		Softwood		Twist Drill	
	Twist Drill		Twist Drill			
	inches	mm equiv.	inches	mm equiv.	inches	mm equiv.
0	1/32	.79	1/64	.40	1/16	1.59
1	3/64	1.19	1/32	.79	5/64	1.98
2	3/64	1.19	1/32	.79	3/32	2.4
3	1/16	1.59	3/64	1.2	7/64	2.78
4	1/16	1.59	3/64	1.2	7/64	2.78
5	5/64	2.0	1/16	1.59	1/8	3.18
6	3/32	2.38	1/16	1.59	9/64	3.57
7	3/32	2.38	1/16	1.59	5/32	3.97
8	7/64	2.78	5/64	1.98	11/64	4.37
9	7/64	2.78	5/64	1.98	3/16	4.76
10	1/8	3.18	3/32	2.4	3/16	4.76
11	9/64	3.57	3/32	2.4	13/64	5.16
12	5/32	3.97	7/64	2.78	7/32	5.56
14	3/16	4.76	7/64	2.78	1/4	6.35
16	3/16	4.76	9/64	3.57	17/64	6.75
18	13/64	5.16	9/64	3.57	19/64	7.54
20	7/32	5.56	11/64	4.37	21/64	8.33
24	1/4	6.35	3/16	5.16	3/8	9.54

LENGTHS OF THE MORE COMMONLY USED SCREW GAUGES		
Number	Inches	Closest mm Equivalent
2	1/4 to 1/2	6 to 12
4	1/2 to 1 1/2	12 to 38
6	3/8 to 3	9 to 75
8	3/8 to 4	9 to 100
10	5/8 to 5	16 to 125
12	3/4 to 6	18 to 150
14	1 to 6	25 to 150
16	1 1/2 to 6	38 to 150

DIMENSIONS OF STOCK LUMBER				
End Section	Imperial (Inches)		Metric ( millimeters)	
	Nominal Size (what you order)	Actual Size (what you get)	Nominal Size (what you order)	Actual Size (what you get)
	1 x 2	3/4 x 1 1/2	25 x 50	19 x 38
	1 x 3	3/4 x 2 1/2	25 x 75	19 x 63
	1 x 4	3/4 x 3 1/2	25 x 100	19 x 90
	1 x 6	3/4 x 5 1/2	25 x 150	19 x 140
	1 x 8	3/4 x 7 1/4	25 x 200	19 x 184
	1 x 10	3/4 x 9 1/4	25 x 250	19 x 235
	1 x 12	3/4 x 11 1/4	25 x 300	19 x 286
	2 x 2	1 1/2 x 1 1/2	50 x 50	38 x 38
	2 x 3	1 1/2 x 2 1/2	50 x 75	38 x 63
	2 x 4	1 1/2 x 3 1/2	50 x 100	38 x 90
	2 x 6	1 1/2 x 5 1/2	50 x 150	38 x 140
	2 x 8	1 1/2 x 7 1/4	50 x 200	38 x 184
	2 x 10	1 1/2 x 9 1/4	50 x 250	38 x 235
	2 x 12	1 1/2 x 11 1/4	50 x 300	38 x 286
	3 x 4	2 1/2 x 3 1/2	75 x 100	63 x 90
	4 x 4	3 1/2 x 3 1/2	100 x 100	90 x 90
	4 x 6	3 1/2 x 5 1/2	100 x 150	90 x 140
	6 x 6	5 1/2 x 5 1/2	150 x 150	140 X 140
	8 x 8	7 1/2 x 7 1/2	200 x 200	184 x 184

N.B. The sizes have been rounded off to the nearest millimeter

Dear Parent/Guardian:

I look forward to having \_\_\_\_\_ join our 4-H club. The project focus is Woodworking. If you would like your son/daughter to participate, this letter must be signed below and returned to me by the first meeting.

This project aims to have the members develop some understanding of:

- Wood's basic properties
- How different woods vary and why they are used the way they are
- The skills required to work with wood
- The importance of wood in both the manmade and natural environment.

To accomplish this, hands-on activities with wood and tools will take place during the meetings. Proper tool use and workplace safety will be stressed throughout this project. Use of power tools is limited to an electric drill and perhaps some others for more experienced members. If your son/daughter is completing a task at home for this project, we ask that you observe, to ensure this is being done safely.

Please call me if you would like more information about this project. My phone number is \_\_\_\_\_.

Sincerely,

4-H Leader

Yes, \_\_\_\_\_ has my permission to participate in the 4-H Woodworking project.

\_\_\_\_\_  
Parent's/Guardian's Signature

# PROJECT SUMMARY - WOODWORKING

(complete at the end of the project)

## A. Member Comments:

1. I joined this club because ... \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. I really enjoyed ... \_\_\_\_\_  
\_\_\_\_\_

I didn't enjoy ... \_\_\_\_\_  
\_\_\_\_\_

3. If I was to take this project again, I would change ... \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. I learned ... \_\_\_\_\_  
\_\_\_\_\_

5. I'm glad ... \_\_\_\_\_  
\_\_\_\_\_

## B. Parent/Guardian Comments: \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

## C. Leader Comments: \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

This project has been completed satisfactorily.

Member \_\_\_\_\_ Leader \_\_\_\_\_

Date \_\_\_\_\_ Leader \_\_\_\_\_