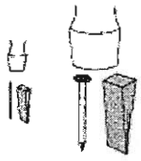
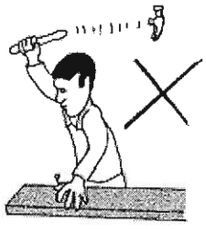
SECTION **Carpentry**

SAFETY PRACTICES

HAMMER SAFETY

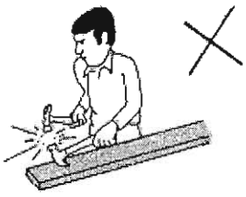


Use Correct Size Hammer



Never use a hammer with a loose head

Never use two hammers together

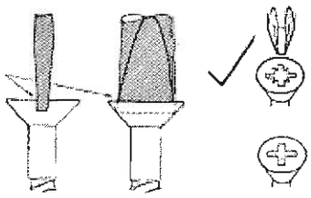


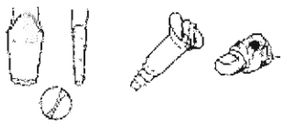
Never use the side of the hammer

Never strike cold chisels or hard objects with a nail hammer

SCREW DRIVER SAFETY

Use Correct Size Screw Driver





Worn tip damages screw and finger

Never use a screw driver with rounded edges or tips

Never hold the work in one hand

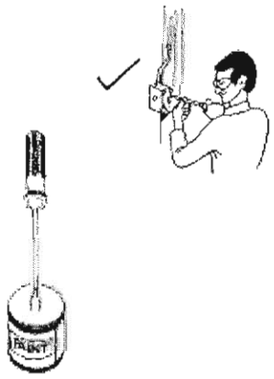
Never use a screw driver for prying, punching, chiseling or scraping

Always drill a pilot hole while driving screws

A little wax on the thread ease the job

The wood will split if you drive a screw too close to the end of the work without first drilling a pilot hole

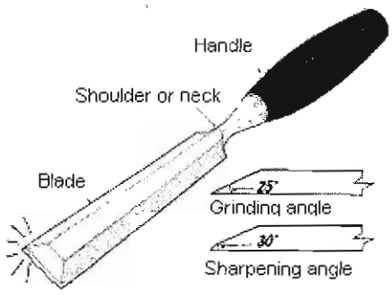
Use an insulated screw driver for electric work

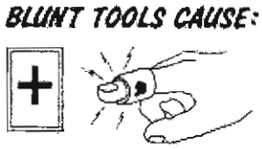


Never use a screw driver for stirring paints

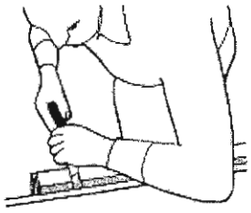
CHISEL SAFETY

Keep sharp at all times; Blunt tools cause damage

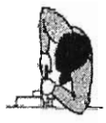


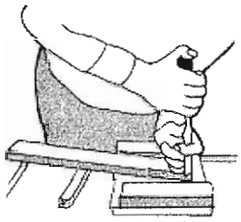


Keep all parts of body behind cutting edges



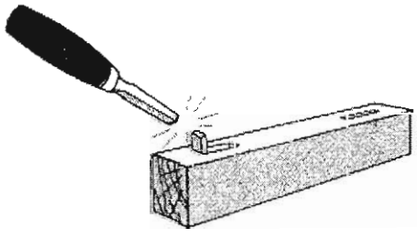
Note the position of elbow and position of hands





Timber supported, note position of hands

Never try and cut too much material



DEFINITION

Carpentry is the trade or work of a person of woodwork basically to construct buildings, ship etc.

OBJECTIVES

After going through this section the student will be able to :

- Identify and select the right type of wood for various applications.
- Acquire required knowledge and practical skills in wood cutting, joining and other allied operations.

WORKBENCH

A typical carpentry worktable is shown in fig. 2.1. The table height will be approximately 3 feet. It consists of a sturdy heavy base, with adjustable feet for uneven floors. The top is fitted with a laminated hard maple plank planed and scraped smooth. A quick action cast iron vice with wooden jaws is fitted at one end.

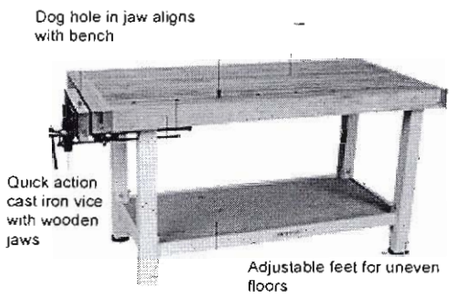


Fig. 2.5 Typical Carpentry worktable

Fig. 2.1 Typical Carpentry Work Table

TYPES OF MATERIAL

Numerous species take on different characteristics. All are composed of 60% cellulose and 28% linen. These substances make up the fibrous and woody cell walls of plants and trees and are held together by cementing prop[illegible] id colors are the elements remaining, of about 12%. Other ch[illegible] ıe wood is sawed and cured. There are hardwoods from deciduous trees and softwoods from coniferous trees.

CLASSIFICATION OF WOOD

Woods can be classified as (i) Hard Wood (ii) Soft Wood

HARDWOOD

AFRICAN MAHOGANY, BLACK WALNUT, WHITE OAK, RED OAK, MAPLE, ASH, CHERRY, HICKORY, BALSA, CYLON SATINWOOD, RATN, BEECH, BRICH, WILLOW, EAST INDIAN EBONY, TEAK and PEAR fall under the category of hard wood. The general properties of hard wood and their uses are given below:

Appearance : Generally straight grained with a moderately coarse, uniform texture. Rich dark brown heartwood and nearly white sapwood.

Physical properties : Moderately heavy, hard, strong and stiff, with good decay resistance and dimensional stability.

Working properties: Works very well with machine or hand tools. Excels at turning, modeling, routing, shaping, carving and drilling. Sands easily and finishes to a velvety, natural-coloured sheen.

Uses: Ideal for gun stocks due to dimensional stability and ability to absorb recoil. Also for decorative panels , interior joinery, novelty carving, turnery, boat building , clock cases and musical instruments.

SOFTWOODS

PINE, DOULAS-FIR, REDWOOD, CEDAR etc. are few examples of softwood. The general properties of soft wood and their uses are given below:

Appearance : Generally straight grained, but Atlantic and Lebanon cedars are often knotty. Fine textured. Light brown resinous heartwood and Pale coloured sapwood.

Physical Properties: Medium weight, low shock resistance and stiffness and generally low strength. Stable in service. The heartwood is decay resistant.

Working properties: Works fairly well with hand or machines tools although knots and in-grown bark can be troublesome. Holds screws and nails well and polishes to a nice finish.

Uses :Higher grades are used for furniture, cabinetry, doors, and interior joinery. Lesser grades are used for house and bridge construction, paving blocks, and outdoor furniture. Other uses include paneling and decorative veneers.

CARPENTRY TOOLS

Classification

a) Marking and Measuring Tools – Pencil, knife, steel rule, steel tape, marking Gauge, Trysquare, etc.

b) Holding Tools – Bench Vice, Clamps

c) Cutting Tools and Shaping Tools – Saw, Chisel, Drill.

d) Smoothing and Finishing Tools – Planes, Rasp, Sand Paper (Emery Sheet)

e) Fastening and Removing Tools – Hammer, Mallet, Screw Driver, Wrench, Spanners, Pliers

MARKING, MEASURING and LAYOUT

Pencil - Pencils aren't precise enough for most marking, but a package of cheap mechanical pencils will be handy to have around.

Knife - The best marking tool is a knife. The blades of the knife should be fine so that it can follow a straightedge.

Steel rule - A good metal ruler with graduations in centimeter & millimeter on one edge and inch on the opposite edge. This is handy for measuring and as a straightedge.

Steel Tape – The tape is a flexible steel ruler coiled in a compact steel casing. This is used to measure large dimensions in one stretch (upto 2 meters). Since the tape is flexible, measurements can be made on curved parts also.

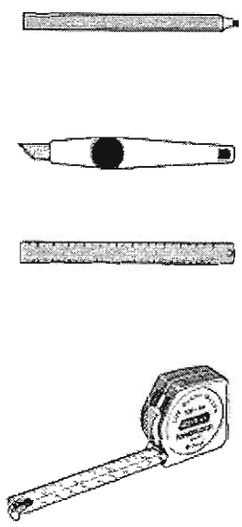


Fig. 2.2 Marking Tools

Marking/ Measuring Gauge

It consists of a square bar of required length with graduations of a scale on one side of the square along the length of the bar. A square slide with a thumb screw slides along the length of the bar. The thumbscrew allows the slide to be moved along the rule and locked in place. A scribing point at the '0' mark makes the scratch in the wood.

The measuring gauge is used to mark lines and set distances from the edge of a piece of wood.

Mortise Gauge

It is similar to the marking gauge in construction except that there will be two scribing points(Spur), one fixed and the other adjustable.

It is used to mark parallel lines of width equal to the distance between

the fixed and adjustable points.

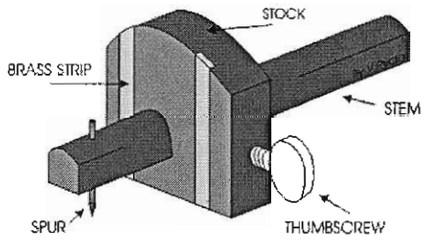


Fig. 2.3 Marking Gauge

TRY SQUARE

It consists of a steel blade fitted with a wooden handle in such a manner that the handle and the blade are mutually perpendicular. Other variations of Trysquare are *Mitre Square* and *Bevel Square*.

The Trysquare is used to mark perpendicular lines along the work piece with a pencil or scribing tool. It is also used to check the flatness of any surface or squareness of two adjacent edges.

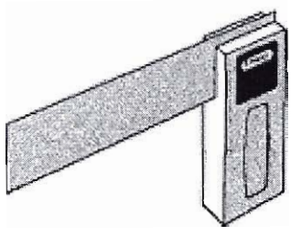


Fig. 2.5 Try square

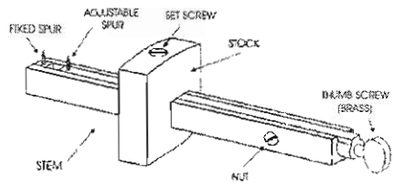


Fig. 2.4 Mortise Gauge

HOLDING TOOLS

Carpentry Bench Vice

It consists of one fixed jaw and one movable jaw. The distance between the jaws can be adjusted by a screw and nut arrangement. The entire vice can be rigidly fitted on a bench (or) table.

Basically this is used to hold long bars of wood for woodworking.

C (or) G clamp

It has a 'C' (or) 'G' shaped frame. Through one of the frame, a lead screw and nut arrangement is provided. The other end of the frame acts as a stop.

It is used for clamping large wooden planks rigidly on a table. It can also be used for applying constant pressure on the wooden pieces that are glued together for better adhesion.

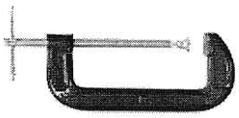


Fig. 2.6 C Clamp

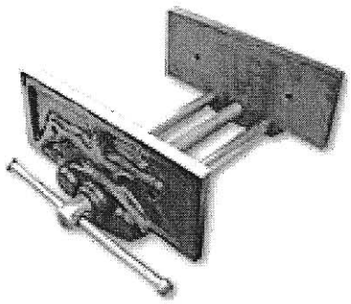


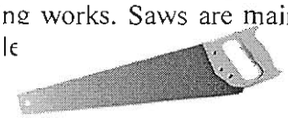
Fig. 2.7 Bench vice

CUTTING TOOLS AND SHAPING TOOLS

Saws

Saws are the most widely used woodworking tools. It consists of a toothed blade made of steel fitted to a ergonomically designed wooden handle. The teeth are the cutting points. Depending on the angle and the pitch of the teeth, saws are used for various wood cutting works. Saws are mainly specified by the pitch in number of teeth per inch (TPI) and the overall le

The different types of saws and their uses are listed below:



Cross Cut Saw

- It is used for woodcutting across the wood grain.
- Usually the size of the saw will be 24" to 26" long with 8 to11 tpi.
- It doesn't cut as aggressively as rip saw but leaves a much smoother ed

Rip Saw

- It is used for woodcutting with the wood grain.
- Usually the size of the saw will be 24" to 26" long with 4 to 7 TPI
- It cuts very aggressively and leaves slightly rough edge

Panel Saw : (Short Cut or Box Saw)

- It is used for woodcutting across the wood grain.
- It is usually shorter than regular cross cut saw and hence easily portable.

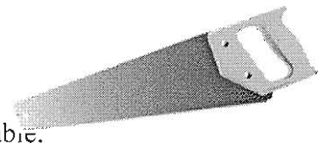


Fig. 2.8(a) Various types of Saw

Bow Saw

- It has a tubular steel frame with a ribbon-like, high-tension steel blade.
- It is used for woodcutting in any direction.

Coping Saw

- It has deep steel tension frames and very thin blades to allow the user to make.
- It is used for fine woodcutting, coping joints intricate cuts at extreme angles.

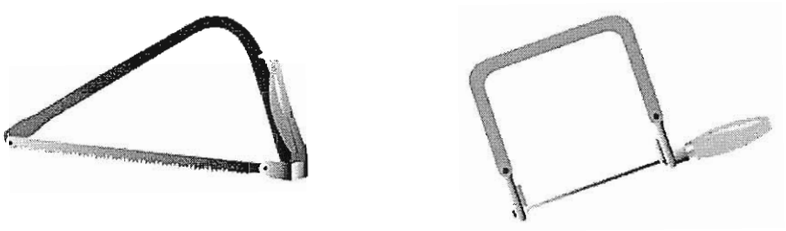


Fig. 2.8(b) Various types of Saw

Back Saw

- It has a rigid piece along the back to prevent the saw from kinking during use.
- It is used for fine woodcutting, moulding and triming.

Dovetail Saw

- It has rigid back like backsaw, but is usually smaller and have finer teeth.
- It is used for wood joint cutting.

Keyhole Saw

- It is used for circle and curve cutting in wood
- It has very thin, pointed blades for cutting small, tight radius curves and holes

Compass Saw

- It has longer, coarser blades than keyhole saws
- It is used for circle and curve cutting in wood
- It is designed for slightly heavier work like cutting holes in sub flooring for plumbing or electrical wiring Chisel.

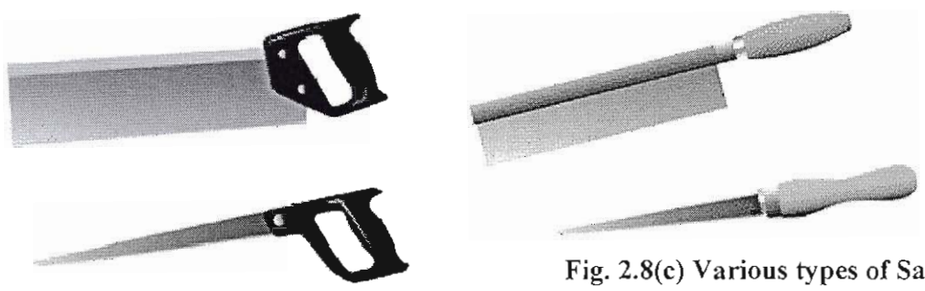


Fig. 2.8(c) Various types of Saw

Chisel

A chisel is a metal tool with a sharp beveled edge, used to cut and shape stone, wood, or metal. It is typically made of hardened or tempered steel or more rarely, common steel. It consists of a sharpened end (called the blade) attached to a straight handle. The handle of most chisels are made from ash, beech, box wood or plastic The handle and blade of some types of chisels are made in one piece.

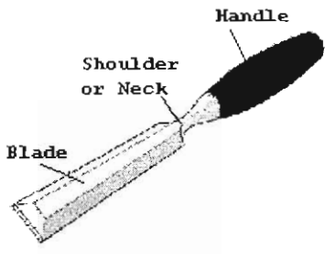


Fig. 2.9 Parts of a chisel

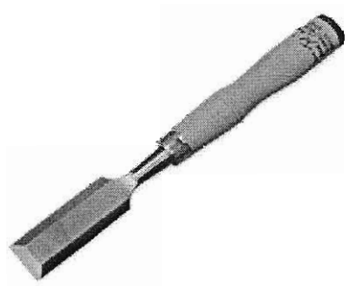


Fig. 2.10 Bevel Edge Chisel

Types of Chisel

While using a chisel, the worker forces the chisel, into the material to cut the material. The driving force may be manually applied, or in some cases using a mallet (not a hammer).

Chisels can be classified as

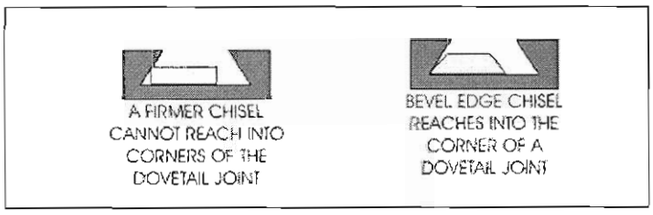
(i) Wood working chisels - used to remove sections of wood
(ii) Cold Chisels - used to remove sections of metal

Firmer Chisel

Firmer chisels have a blade with a rectangular cross-section. This means that they are stronger and can be used for tougher/heavier work. It is useful for large scale carvings

Bevel edge Chisel

Bevel edged chisels are slightly undercut making them easy to push into corners.
These are normally used for finishing dovetail joints. It is also widely used for chopping and shaping.
The limitation of Firmer chisel in reaching into the corners as compared to Bevel Edge Chisel is illustrated below:



Butt Chisel

It is the shorter version of the regular, bevel edge chisel with much the same use. Many carpenters carry them for mortising door locks as they are stocky and smaller than a regular chisel

Mortise Chisel

The end section will have an elongated rectangular section. It is thick and rugged. It is used for chopping mortises(rectangular holes or slots)

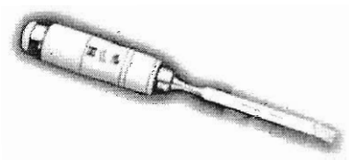


Fig. 2.11 Mortise chisel

Paring Chisel

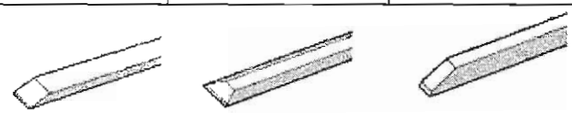
A paring chisel is a longer, thinner chisel which can be pushed into long joints such as housing joints.

It is used for cleaning up the joint and to make it an accurate fit. Used for paring down mortises that have been chopped or drilled, or other delicate work

Skew Chisel
The edge of the blade is perpendicular to the edge of the tool in all other types of chisels but for skew chisels the edge of the blade is angled to the perpendicular, hence skewed.
It is often used by carvers and turners

Differentiating the chisels

Firmer chisel will have Rectangular section	Bevel edge chisel will have Bevel edge section	Mortise chisel will have elongated section



A **gouge**, one type of chisel, is used, particularly in woodworking and sculpture, to carve small pieces from the material. Gouges are most often used in creating concave surfaces. A gouge has a 'U'-shaped cross-section.

Drill

A Drill Tool is meant for making holes. For drilling small holes either a bradawl or hand drill can be used. For drilling large holes a brace and bit is used.

The normal use of Bradawl is to make indentations in wood in preparation for insertion of screws.

The hand drill consists of a cranking handle that turns pinion gears on the main shaft. A chuck at the end of the shaft holds a drill bit. The opposite end of the shaft has a second handle that is held stationary while the chuck turns.

A Brace is a hand tool used to drill holes, usually in wood. Pressure is applied to the top and the tool is rotated with a U-shaped grip.

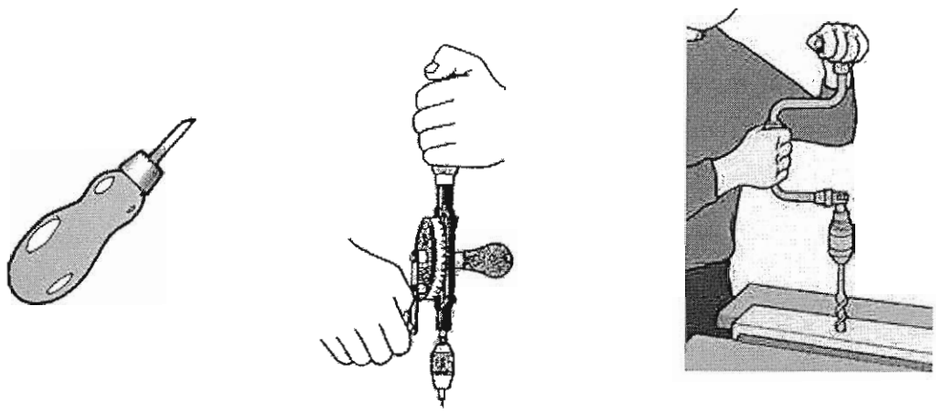


Fig. 2.12 Bradawl, Hand Drill and Brace

SMOOTHING AND FINISHING TOOLS

Planes

These are smoothing and shaping tools and can be treated as an icon for carpenter. The most commonly used plane is a Jack plane which is meant for general purpose work. Other variants are (i) Trying Plane – used for precision work

(ii) Smoothing or Block Plane - used for trimming end grain and small items. Fig. 2.17 shows the parts of a jack plane.

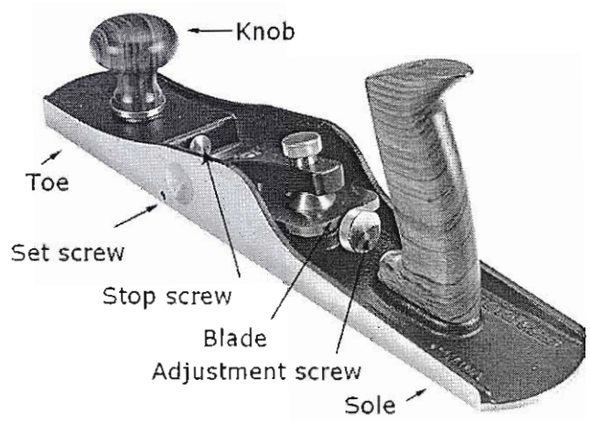


Fig. 2.13 Jack Plane

Rasp

A rasp is a finishing tool used to remove sharp edges and smoothen the surfaces. Similar to files it has different cross sections like half round etc. A half-round rasp is useful for shaping and smoothing semi circular grooves.

Sandpaper

Small particles of abrasives are glued to a flexible thick sheet of paper or cloth. These are called as Sand Papers or Emery Sheets. These are meant for preparing the wooden surfaces as smooth as possible. This operation is usually done before polishing or painting the wood. Depending on the density of the abrasives the sand papers are classified as coarse, medium and fine.

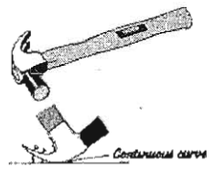
FASTENING AND REMOVING TOOLS

Hammer

These are tools familiar to everyone of us. Basically all hammers have a heavy metallic head with a wooden handle fitted tightly into the head. The construction of the head differs depending on the purpose of its use. The figures shown along side are self explanatory. The hammers are primarily meant for driving or removing nails and for flattenin

Claw Hammer

It is used for driving and removing nails



Claw Hammer Warrington Hammer

Warrington Hammer : It is used for driving sma

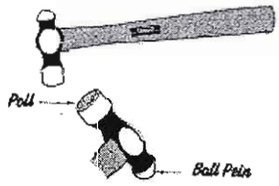
Ball Peen Hammer

It is used for metal working operations and for rive

Mallets

These are wooden hammers used for giving light b

This is extensively used in carpentry and sheet metal work

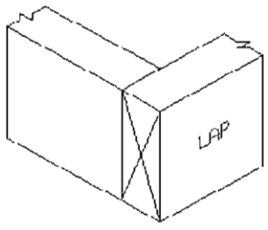


Ball Peen Hammer Mallet

Fig. 2.14 Types of hammers

JOINERY

Joinery is the method by which different pieces of wood are attached, and is often an indication of the quality of a piece of furniture. The manner in which separate components of a chair, table or chest are attached to each other reflects the strength of construction as well as appearance. Listed below are the most common types of joinery used in furniture construction.

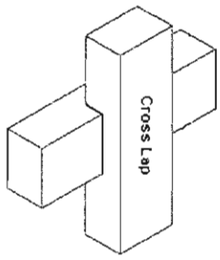


Butt or Lap Joint

A butt joint is a simple method of connecting two pieces of wood with the square end of one piece being placed against the side of another. The two pieces form a right angle and are joined by a nail, screws or a dowel. The end grain of one piece will show from one side or the other.

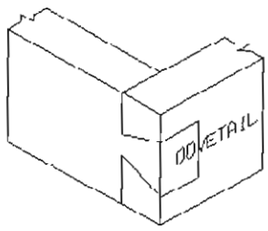
Cross Lapped Joint

In a cross lapped joint, a rectangular section is cut out of each of two pieces of wood that are to be joined. The recess is cut from each piece at the point where they intersect. The recessed surfaces interlock and must be equal in depth so that when the two pieces are joined they are flush.



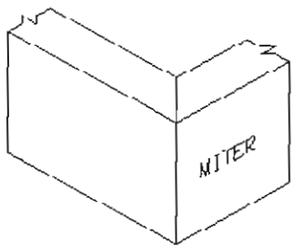
Dovetail Joint

Dovetail joints connect two pieces of wood by flaring the end of one piece to conform to the shape, which is cut out of the second piece. It is the strongest of all joints. If the end of the flared piece does not extend all the way through the second piece it is an invisible joint and called a stopped or lapped dovetail joint. This method is commonly used on drawers and cabinets. A dovetail joint can also be used to join several pieces together, with each piece having a flared end and a cut end.



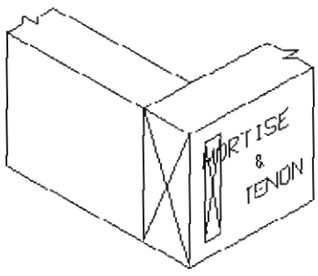
Miter Joint

In a miter joint, two pieces of wood are cut at a forty-five degree angle and the two beveled edges are placed end to end. They are usually connected by glue, nails or screws. These joints are best looking as no end grain shows. It is difficult to construct.



Mortise and Tenon

In this method of joinery, one piece is called the mortise and the other is the tenon. The mortise is a shaped recess, and the tenon is a carved projection, usually rectangular. The tenon is inserted into the mortise in the same way a peg is inserted into a hole. The two pieces are generally secured by drilling a hole through the two pieces and inserting a dowel. The joint is very strong and is commonly used for connecting chair or table rungs to legs.



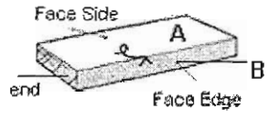
GENERAL PROCEDURE FOR PREPARING AND MARKING

I. Preparing

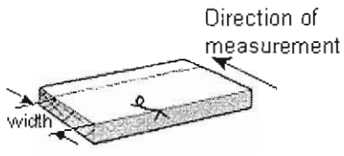
1) Measure and check the overall dimensions of the given workpiece and make sure the required component can be made with the given workpiece.
2) Usually the timber provided will be long enough to produce both the mating pieces required for the joint. Therefore first you have to measure and cut into 2 pieces to be able to produce the male part from one piece and the female part from the other piece. The measurement for the length can be made using steel tape after providing allowance for finishing operations. Mark any one piece as '1' and the other piece as '2' with pencil
3) Atleast one face should be smooth and plane, to make that face as reference for measuring and marking purposes. This face is called as **Face Side (A)**. Check the flatness with steel rule as shown in figure (b).
4) Check the perpendicularity of the adjacent surface with the face side and mark that edge as **Face Edge(B)** in pencil.
5) If required make one end of the wooden piece , plane and true

II. Marking

1. If the length to be marked is long, say, more than 100 mm, then use a steel tape to measure and mark (using pencil or knife) from the face edge **(B)**, keeping the tape parallel to the direction of measurement.

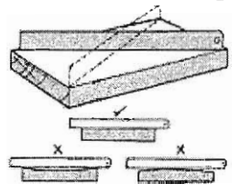


(a)

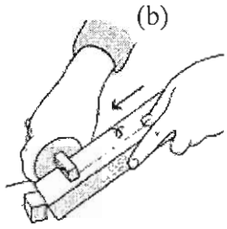


(c)

Produce one true flat surface, check with steel rule for flatness along length, across width and across diagonals



(b)



(d)

2. If the length to be marked is short, say less than 100 mm, then use a marking gauge as described below.
   i. Loosen the thumb screw and slide the square block of the marking gauge to the required length and lock in place.
   ii. Place the square block butting against the face edge**(B)** so that the scribing pin is perpendicular to the face where marking is to be made.
   iii. Now glide along the butting surface to and fro to obtain a clear marking on the wooden piece. The marked line will be parallel to the gliding / reference surface.