



# 14 Hand Tools

## KEYWORDS

- brace
- bradawl
- bevel
- bit
- callipers
- chisel
- compass
- cramp
- file
- gauge
- hammer
- kerf
- marking
- mallet
- pincers
- plane
- pliers
- punch
- rasp
- saw
- screwdriver
- spokeshave
- try square

## LEARNING OUTCOMES

- 1.1, 1.2, 1.3, 1.7, 1.8, 1.10
- 2.3, 2.6, 2.11, 2.12

## Learning intentions



At the end of this chapter you will be able to:

- Be able to identify basic hand tools, their name, parts and function.
- Use basic hand tools safely and appropriately.

⚠ All of the many hand tools in the Wood Technology room should be used as instructed to keep you safe.



## Marking out

Accuracy is the key to successful work. Steel rulers and measuring tapes are used to measure accurately. Distances are measured in millimetres (mm).

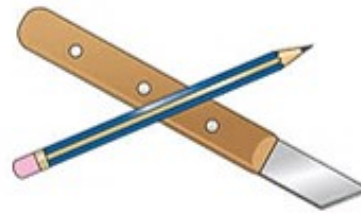
⚠ Measure twice. Cut once.



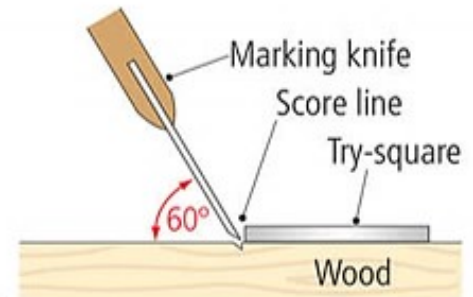
Steel rulers

## Marking knife

A sharp 2H pencil is used to draw lines on wood and other materials. The **marking knife** is used to mark lines to be cut with a saw. The knife cuts the wood fibres which leave a clean finish when the wood is cut. It is also used to cut card, veneer, and light material. You must be careful when using any knife, so as not to cut your fingers. Also, any line scored in the wood is very difficult to remove.



Pencil and marking knife



Why is the marking knife tilted at an angle when being used?

## Try square

The **try square** is used to draw lines across the faces of material at right angles to the face side and edge. It is also used to check if surfaces are square to each other.



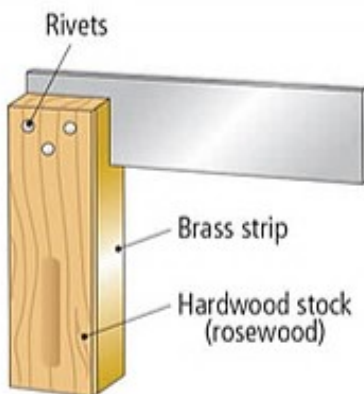
Try square



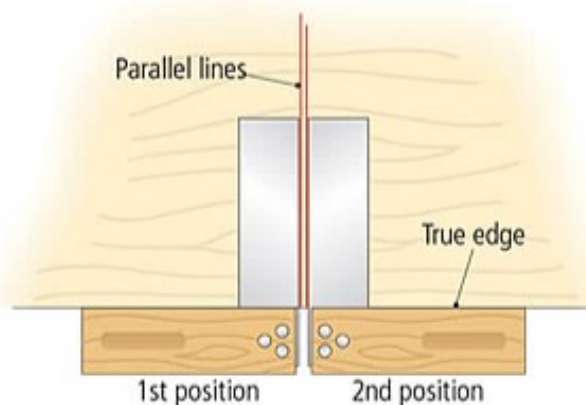
Squaring lines across timber

*Try the try square*

On a scrap piece of wood, test the try square in your bench to check if it is perfectly square.



Parts of a try square



Testing the try square for accuracy

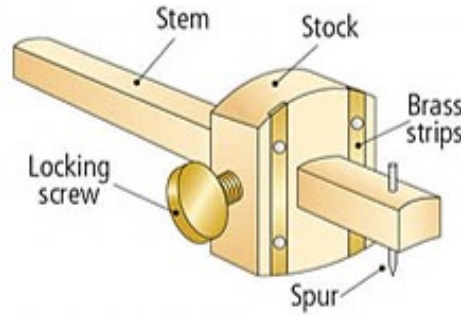
The blade of the try square is at  $90^\circ$  to the stock. Different sizes of blade can be obtained between 100–300mm. The square must be protected from damage and regularly tested for square.



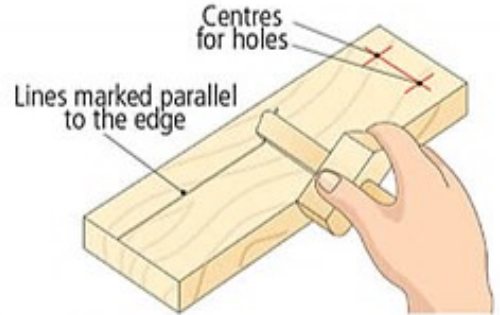
### Marking gauge

Marking gauges are made from beech. They have a plastic locking screw. Brass strips in the stock help to reduce wear.

The **gauge** is used by holding the stock firmly against the edge while dragging the spur so it scores the wood.



Parts of the marking gauge



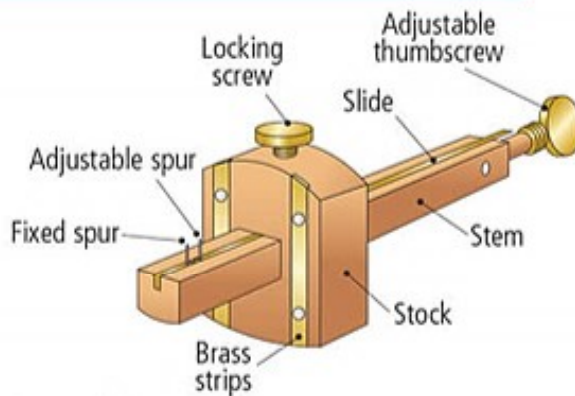
Using the gauge

### USES

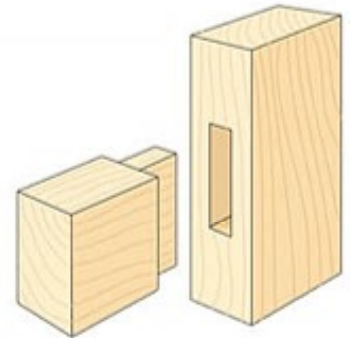
- To mark lines in the wood parallel to an edge or surface
- To mark centre points for holes to be drilled

### Mortise gauge

Similar to the marking gauge, the mortise gauge has two spurs and is made from a hardwood – usually rosewood or mahogany. It has one fixed spur while the second spur is adjusted by a thumbscrew on the stem.



Parts of the mortise gauge

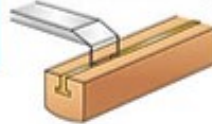


Mortise and tenon joint

### USES

- To mark two parallel lines at once
- For marking a mortise and tenon joint

Using a mortise chisel to set the distance between the spurs



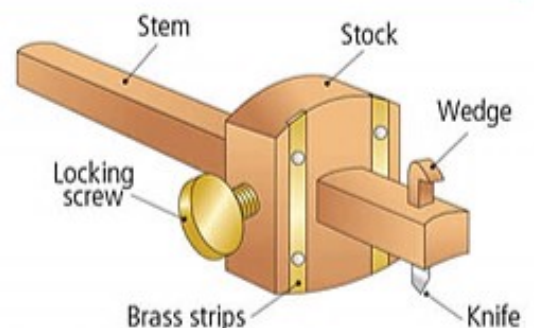
Using the rule to set the distance between the stock and the first spur



Setting the mortise gauge

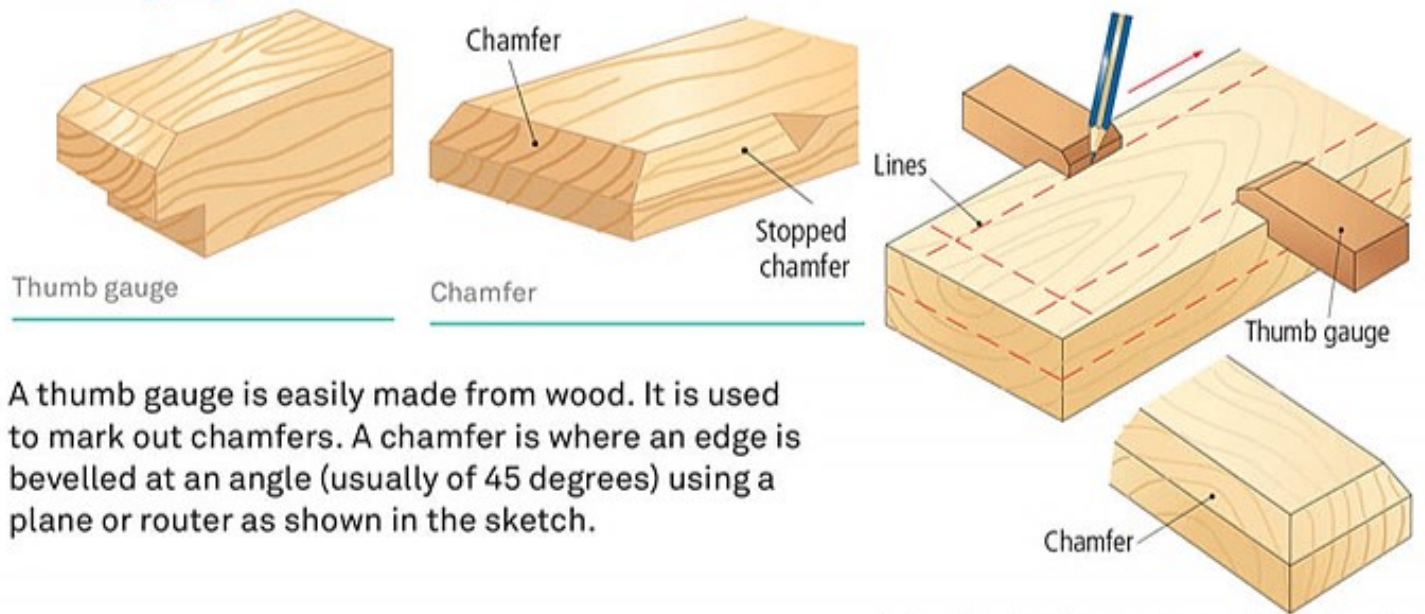
### Cutting gauge

The cutting gauge uses a small blade in place of a spur. The small blade is held in place using a wedge or screw.



Parts of a cutting gauge

## Thumb gauge



Thumb gauge

Chamfer

Lines

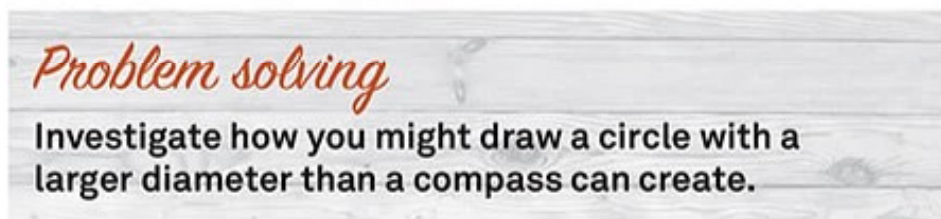
Thumb gauge

Chamfer

Using the thumb gauge to mark out chamfers

## Compass / dividers

Your compass or dividers can be used to mark circles or curves onto wood or other materials. The dividers can also be used to check measurements.



Compass and dividers

## Sliding bevel

The sliding bevel is used to mark lines of various angles on the wood. Similar to the try square, the blade can be adjusted easily to set the required angle.



Sliding bevel being set to a setsquare

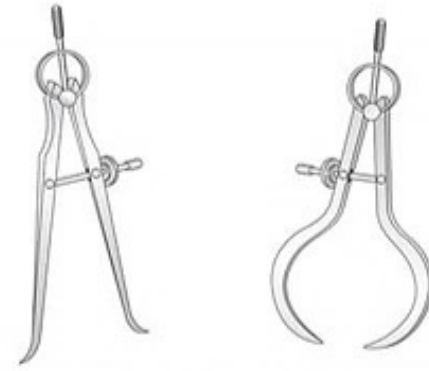


Sliding bevel in use

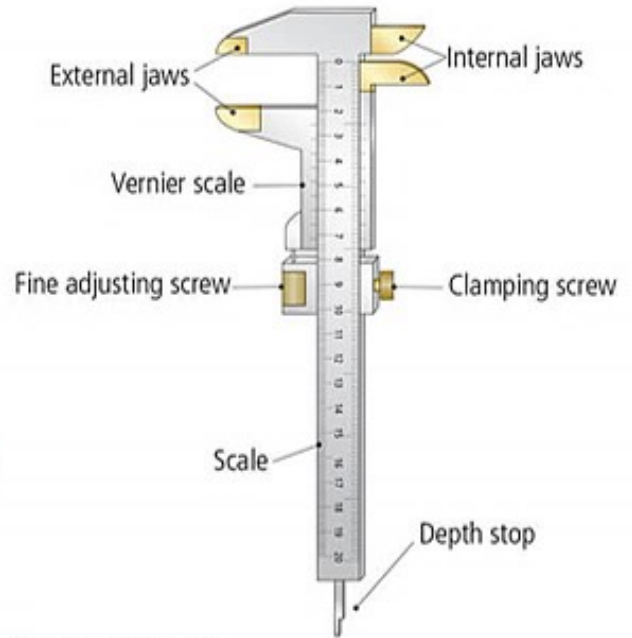


### Callipers

The Vernier callipers are the most popular callipers and are very useful for taking and transferring measurements. They are very accurate because the external jaws are used to measure the outside diameter of a cylinder (pipe/woodturning).



Inside callipers and outside callipers



Vernier callipers

### Cutting Tools

#### Saws

Saws come in many varieties, each designed for a particular use. Machines and power tools are becoming popular, but handsaws are still used for their safety, accuracy, and portability.

Handsaws can be divided into three groups according to use:

- Cutting larger sections and sheets
- Cutting smaller sections and finer cuts
- Curved work.



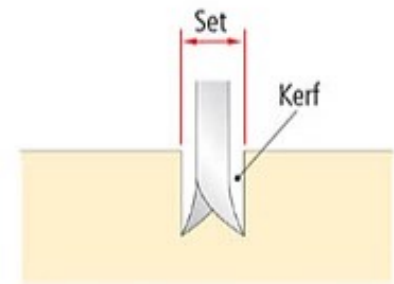
Selection of saws

#### Teeth

The difference between the saws is in the size number and shape of the teeth and the way they cut the wood. The number of teeth per 25mm (inch) of a blade is labelled on the blade. The teeth must be regularly sharpened and protected from damage. Take care to avoid cutting nails hidden in wood.

#### Kerf and Set

- Always cut on the waste side of the line
- The **kerf** is the cut made by the saw teeth. The kerf is wider than the thickness of the blade.
- The teeth of the saw are **set** wider than the blade. This allows the teeth to move freely in the kerf without getting stuck.



The saw kerf (groove) is slightly wider than the blade

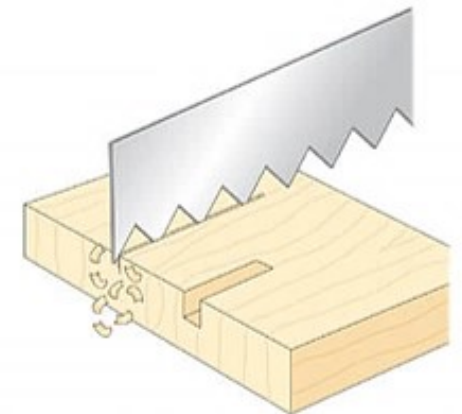
## Large handsaws

### USES

- Cutting larger boards and sheet materials.

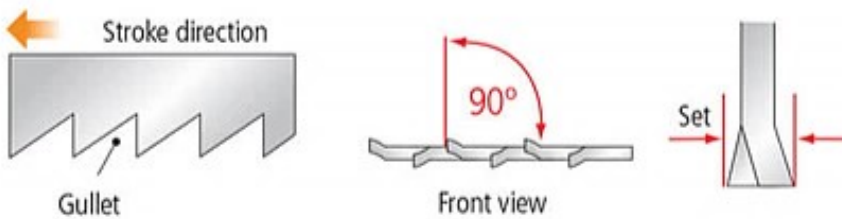


Ripsaw



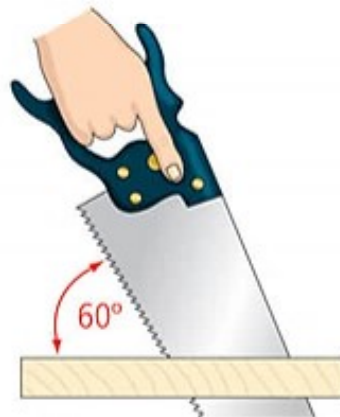
Ripsaw teeth leave a flat-bottomed cut

There are three larger handsaws: the ripsaw, the cross cut saw, and the universal saw. The ripsaw cuts with a chiselling action and is used when cutting with the grain direction. The cross cut saw has teeth shaped like two knives to slice across the grain. The universal saw is the most common and it has teeth which will cut both across and along the grain of the wood.

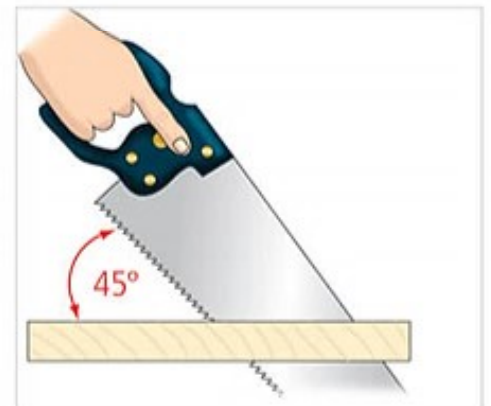


Ripsaw teeth are shaped with 4–8 teeth per 25mm

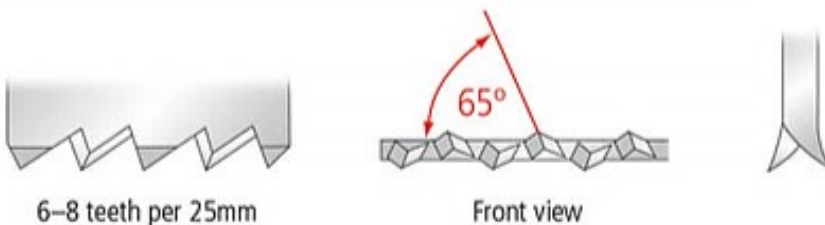
Modern handsaws with very sharp, hardened teeth are inexpensive and therefore tend to be disposed of after prolonged use.



The angle of the blade to the face of the work is 60° for rip sawing



The angle of the cross cut saw is 45° to the work surface when cross-cutting



Cross cut teeth are shaped with 6–8 teeth per 25mm

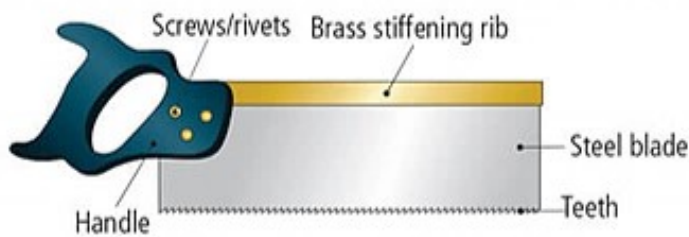


## Tenon saw

### USES

- General light bench work
- Cutting straight lines
- Cutting tenons (as its name suggests)

The tenon saw is the most commonly used saw in the wood technology room. It has a high carbon steel blade, hardwood handle, and a brass strip on the back of the blade to keep it stiff. A tenon saw usually has 10-15 teeth per 25mm.



Parts of the tenon saw

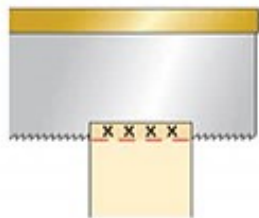


Using the tenon saw

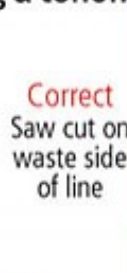
### Cutting a tenon

Cut a tenon with your tenon saw and write out the step-by-step process of how it was done.

### Procedure for cutting a tenon

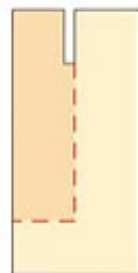


1 Firstly, place the piece vertically in the vice and make a vertical cut down of 5 mm–6 mm.

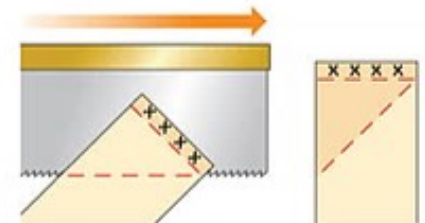
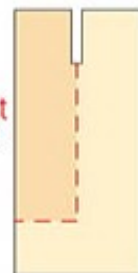


Correct  
Saw cut on waste side of line

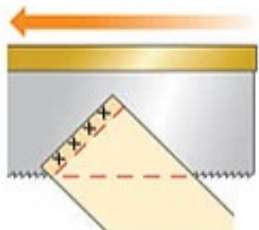
2 Make the saw cut on the waste side of the line that is marked on the timber.



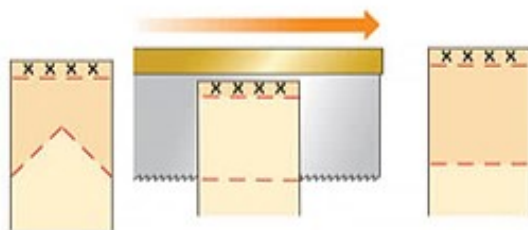
Incorrect  
Saw cut on line



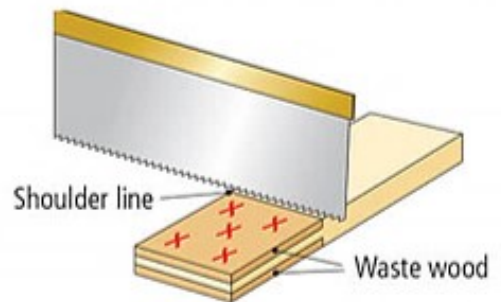
3 Tilt the piece forward and fix it in the vice again. Continue the cut down along the gauge line, keeping the edge of the saw in the full kerf (groove) as the sawing continues.



4 Reverse the piece and repeat the saw cut on the other side. This leaves a small triangular piece unsawn inside the tenon.



5 Fix the piece in a vertical position once more and cut down to the line, sawing through the triangular piece.



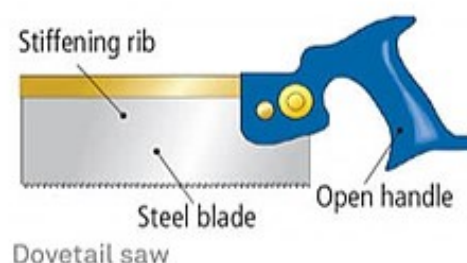
6 Finally, remove the shoulders.

## Dovetail saw

### USES

- Cutting dovetails and other light and fine work

The dovetail saw is smaller than the tenon saw, with finer teeth, usually 18–20 teeth per 25mm.

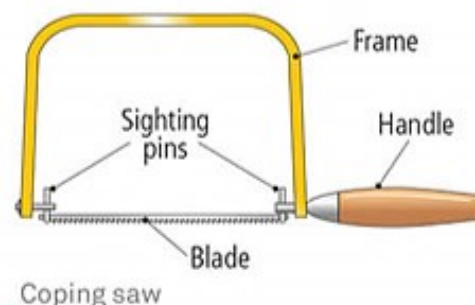


## Coping saw

### USES

- The coping saw is used for cutting curves.

The coping saw has a fine metal blade stretched between two slotted pins in a frame. The blade is tensioned by twisting the handle. The blade can be adjusted or removed by loosening the handle. The blades break easily, but are cheap to replace. Coping saws cut on the pull stroke, so the teeth always point back towards the handle.



How to replace a coping saw blade

### Replacing a broken blade

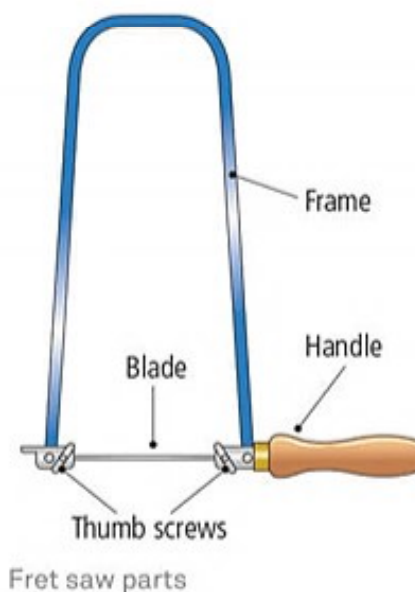
- 1 Remove the old blade or parts.
- 2 Twist the handle to loosen it.
- 3 Slot the new blade into the pins.
- 4 Make sure the teeth point backwards towards the handle.
- 5 Retighten the handle.
- 6 Align the sight pins.

## Fret saw

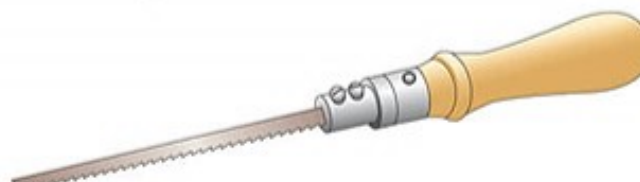
This is similar to a coping saw, but with a larger frame and a very fine blade. It is used in very fine curved cuts in thin sheets of metal plastic and wood.

## Compass saw and pad saw

Both the compass saw and the pad saw are used for cutting small holes in light sheets and in difficult to reach areas. The blades are easily bent, so care is taken when using them.



Compass saw



Pad saw

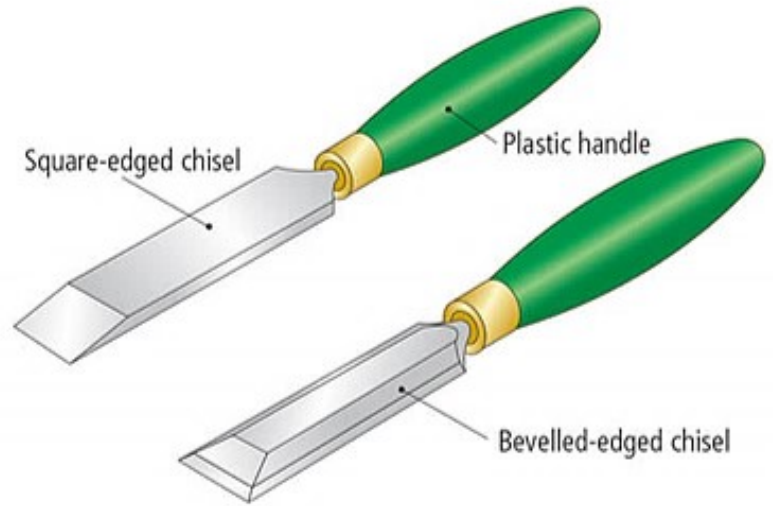


## Chisels

**Chisels** are widely used in wood technology for paring and shaping wood. Their blades are made from high carbon steel. There are two main types, pictured: a square-edged chisel and bevelled-edged chisel. The bevelled-edge chisel is suited to pare into tight corners.

The ferrule is a brass collar that prevents the handle from splitting. Modern chisels have handles of timber or moulded plastic. The edge of the chisel is kept sharp with regular sharpening.

Chisels in your locker are mainly used for paring trenches and paring curves. There are chisels for mortising and specialist chisels for carving and wood turning.

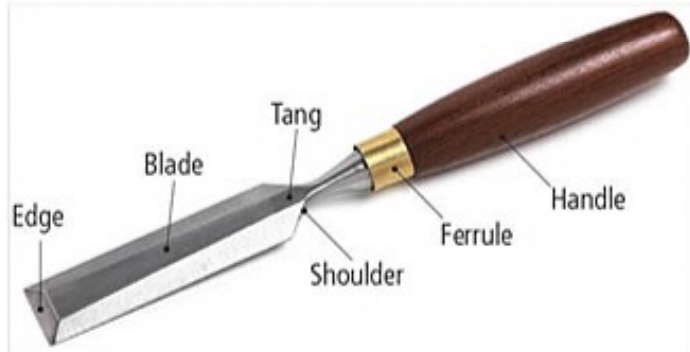


Square-edged chisel will not fit into difficult corners



Bevelled-edged chisel will fit into acute corners well

Square-edged chisel and bevelled-edged firmer chisels



Parts of a chisel

The cutting edge is made of two distinct angles (bevels). The grinding angle ( $20^{\circ}$ – $25^{\circ}$ ) is made by grinding the edge on a grinding stone. The second bevel ( $30^{\circ}$ ) is made by sharpening the edge using an oilstone. Sharpening is also known as honing.



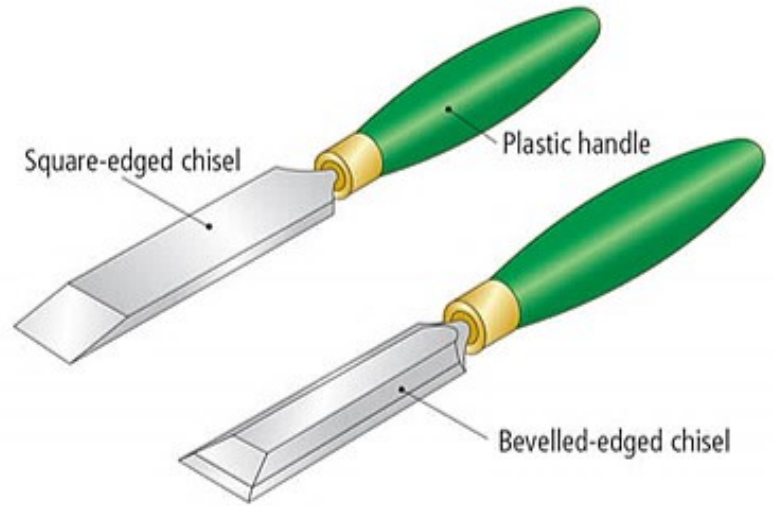
Bevelled-edge chisel

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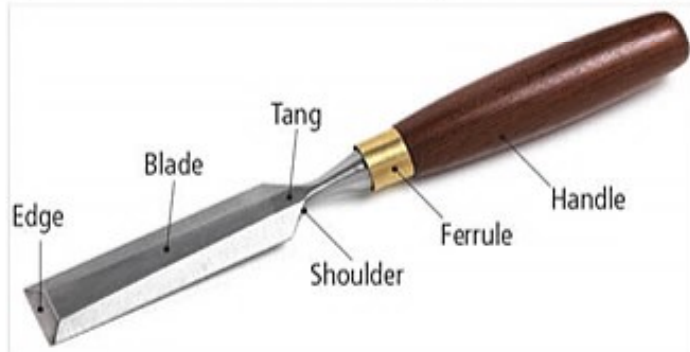


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Bevelled-edge chisel



## Firmer Chisels

### USES

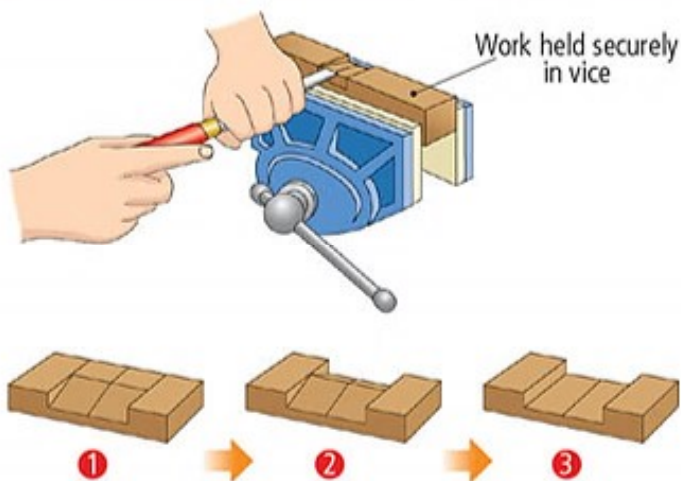
- Paring trenches
- Vertical paring to a line
- Paring curves
- Chamfers

Firmer chisels are available in a variety of widths from 3mm to 50mm.

Always keep both hands behind the cutting edge of the chisel and work away from the body.



Vertical paring



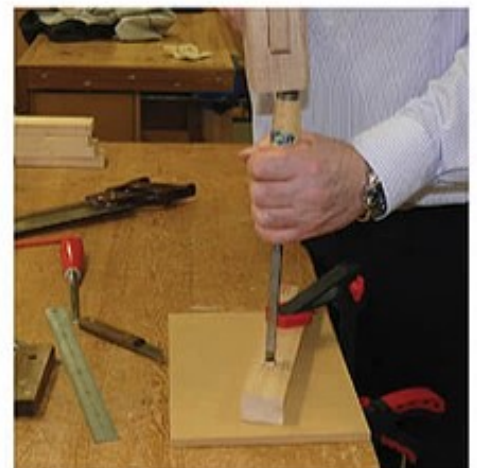
Paring a trench

## Mortise chisel

The mortise chisel has a thicker blade and a stronger handle. It is designed to withstand repeated blows from the mallet while mortising. The handle is made from moulded plastic or durable hardwood strengthened with a metal ferrule to prevent splitting.



Mortise chisel



Using a Mortise chisel

## Hammers and Mallets

Hammers and mallets are impact tools, so they must be strong and durable.

There are a variety of hammers available. They also vary in size according to their weight. The head of a hammer is held on with a wedge. If the head of a hammer is loose, it should be reported to the teacher.

A claw hammer is a heavier hammer used for general work and carpentry (floors, roofs & carpentry). The claw is used to take nails and pins out of wood.

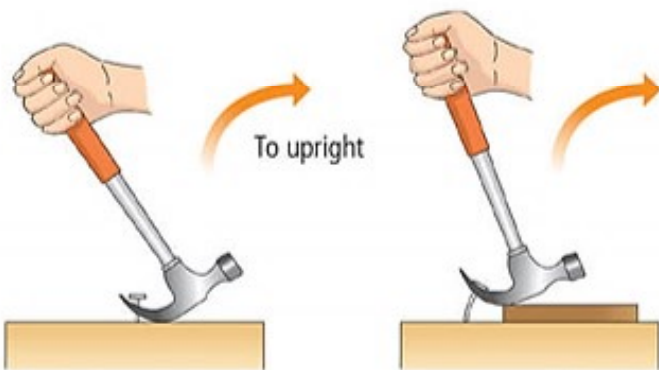


The head of a hammer is held on with wedges



Driving a nail

Fair blow  
– nail struck squarely;  
hand at bottom of shaft



Pack and pull to upright

A claw hammer is used to pull out nails. Why is a waste piece used?

A Warrington hammer is for lighter work, furniture and cabinetmaking, while a pin hammer is for very light work and upholstery.

### *Which hammer for the job?*

For each of the hammers pictured, outline its features and when it is the most appropriate choice.



Claw hammer



Warrington hammer

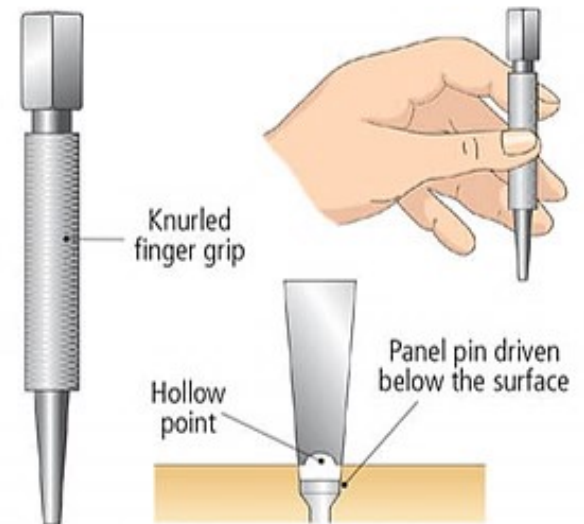


Pin hammer



## Nail Punch

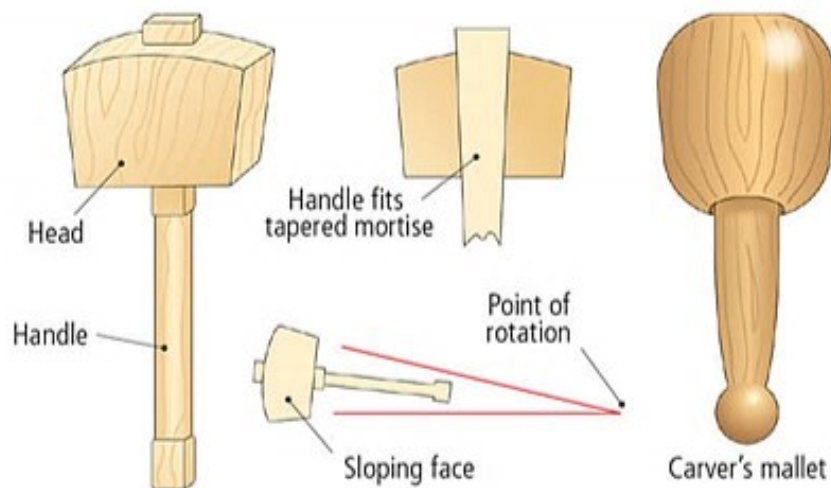
The nail punch is used in the Wood Technology room to drive panel pins and small nails below the surface of the wood. The resulting holes are filled with wood filler and then sanded. The punch has a slightly hollow point to stop it slipping off the head of the pin. Different sizes are available.



Nail punch

## Mallets

**Mallets** are usually made from beech. The faces are shaped so that they strike the top of the chisel squarely. The handle is tapered, so to hold the head firmly on. The carver's mallet is round so that it fits comfortably in the hand and will give good control as the carver strikes the chisel.

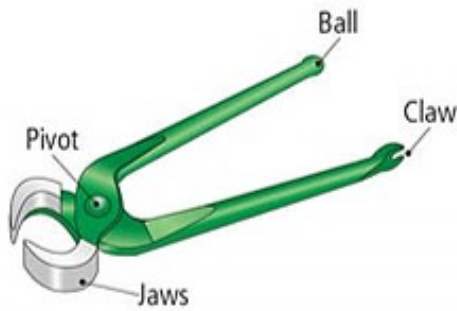


Carver's mallet in use

Mallet and carver's mallet. Why are they made from beech?

## Pincers and pliers

**Pincers** are used to pull nails and panel pins out of wood. They have two handles pivoted in the centre that allow the nails to be tightly gripped.



Use a block of waste wood under the jaws to give better leverage

Pincers. Consider carefully how this tool works. What forces are being used?

Using the pincers

**Pliers** are used for gripping items tightly, twisting, and for work on wires. There are different types suited for different tasks. Common types are pictured here.



Combination pliers, wire cutters, long nose pliers, vice grips, pincers (left to right)



Jaws of a pliers. Consider the function of each part

## Boring tools

A drill or other boring tool is used when holes need to be drilled. They come in different sizes and shapes. The drill bit is gripped firmly by jaws in a chuck. As the chuck turns, the drill cuts through the wood. Some boring tools are powered, while others are manual (hand driven).



## Bradawl

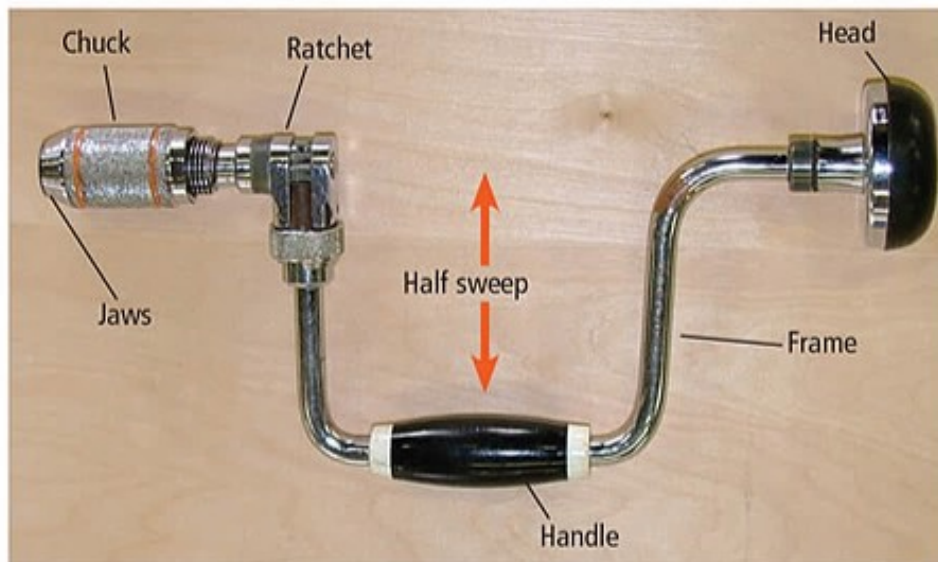
The **bradawl** has a handle and a steel blade. It is used to mark small pilot holes for screws and nails. It may cause splitting if used too close to the end of a thin piece.



Bradawl used to make small pilot holes for nails and screws

## Carpenter's Brace

The carpenter's **brace** has been used for many years. It uses a larger bit to bore holes between 6mm–25mm generally. Special auger bits are used with this drill. Special auger bits are used with this drill.

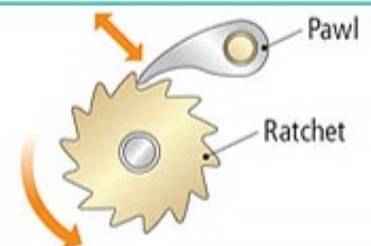


Carpenter's brace

- The jaws hold the bit inside the chuck.
- The brace has a ratchet which allows the bit to turn in one direction only.



Auger bits used in a brace or cordless drill

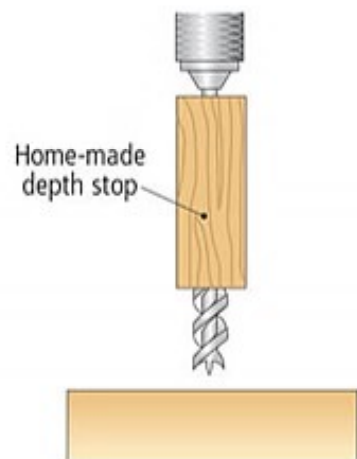


The ratchet mechanism allows movement in one direction only. Where would this be useful?

### Using the brace

Care must be taken when boring a hole through a piece to avoid splintering as the bit breaks through. It is best to bore from both sides, one after the other. A scrap piece may be used to support the back when drilling from one side only.

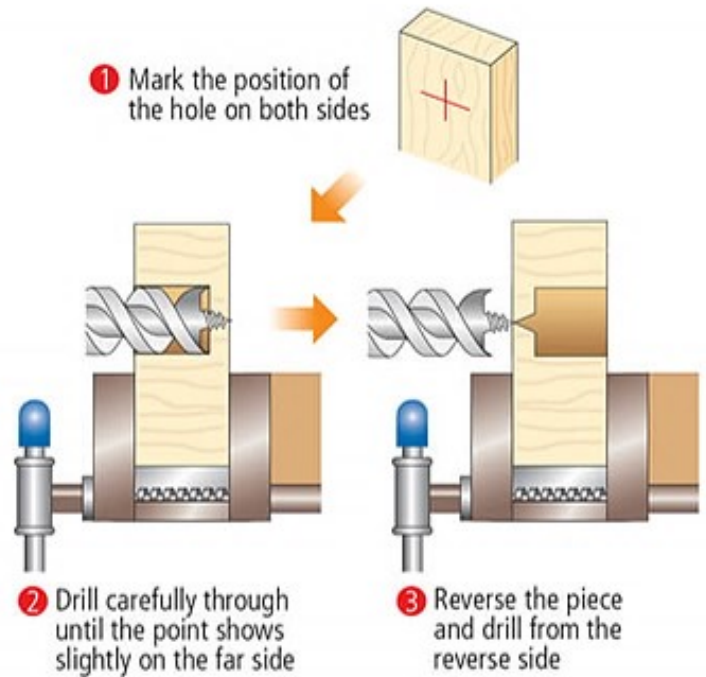
When boring to a specific depth, a strip of tape can be wrapped around the bit to indicate when to stop. Alternatively, a special depth stop can be made as shown below.



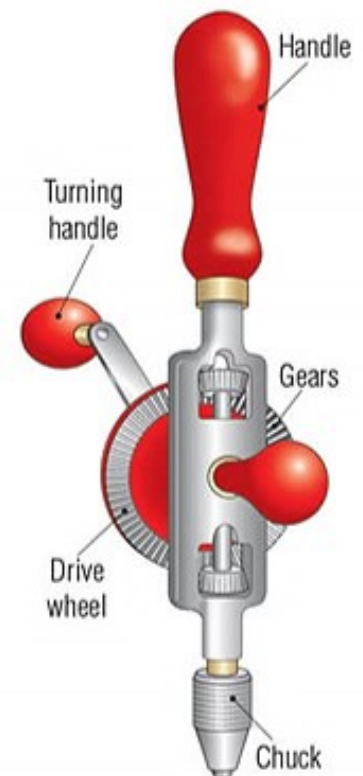
Methods for drilling a hole to a specific depth

### Hand drill

This simple hand drill or wheel brace is used to drill holes of small diameter (1mm–10mm), small pilot holes, or countersinking holes for screws.



Stages of boring a hole with a brace and a bit to avoid breakout

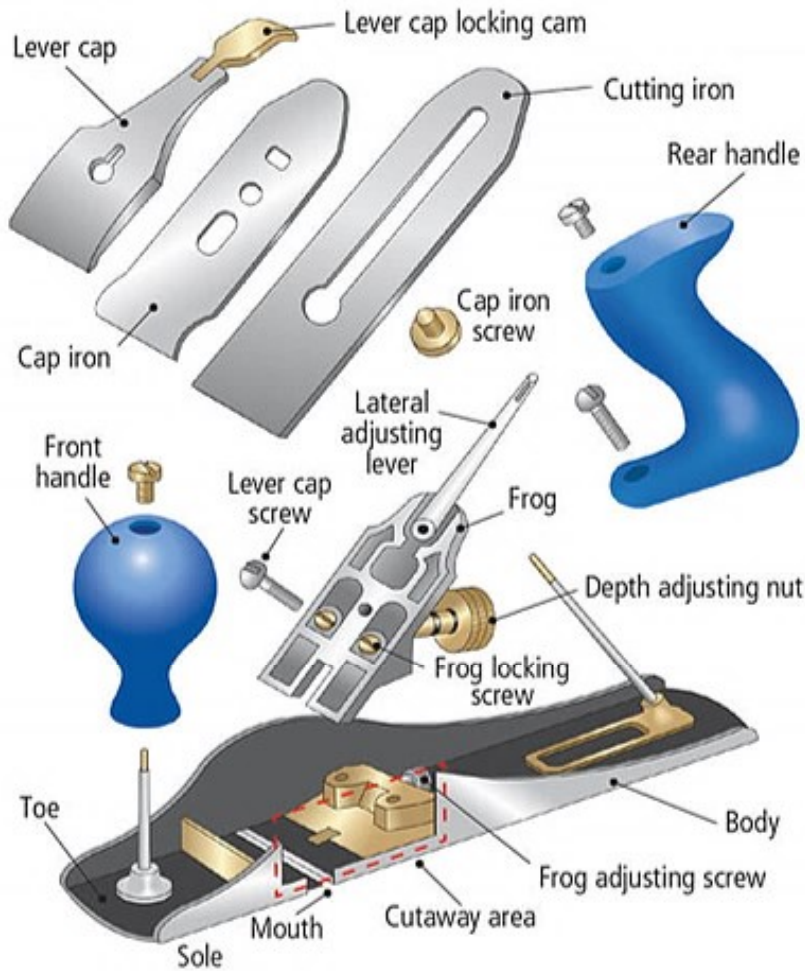


Features of a hand drill



## Planes and Spokeshaves

**Planes** and spokeshaves are tools used to smooth and shape wood. In the past, planes were made from beech wood. Special moulding planes were made by individual craftspeople to suit particular tasks. A lot of smoothing tasks are now done by machine.

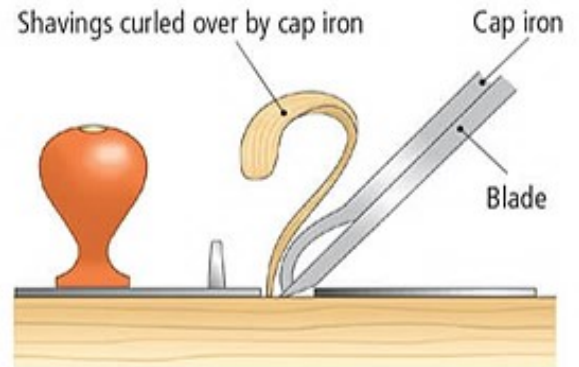


Parts of the plane

### The jack plane

The name jack plane comes from the expression 'Jack of all trades'. It is a general purpose plane. Used to smooth surfaces and square the edges of boards, it is also used to plane material to width and thickness.

The plane should always be left resting on its side because its blade is easily damaged. The blade depth and position can be adjusted easily to take off the correct amount of wood shaving.



The cap iron is shaped to curl the shavings forward, keeping the mouth of the plane clear



Jack plane and smoothing plane. Describe the differences between them.

## The smoothing plane

The shorter smoothing plane is used for smoothing, removing minor blemishes, and preparing surfaces for sanding. It is also used to plane chamfers and basic shaping.

## Try-plane

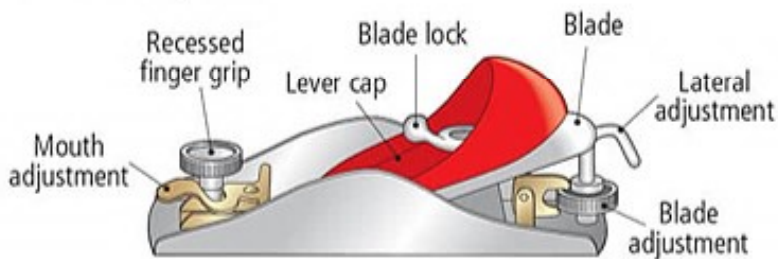
This is a long plane used to plane longer pieces to make them flat. It is used to smooth long boards and for preparing the edges of boards for jointing.



Try-plane

## Block Plane

Small and versatile, the block plane is used for light work, small pieces, chamfers, and planing end grain. It fits easily into the hand, so it is easy to use. Its blade depth is easily adjustable, but it has no cap iron.



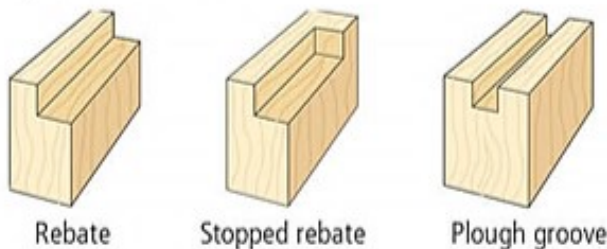
Parts of the block plane



Using the block plane

## Rebate plane and plough plane

These specialist planes were used to remove rebates and plough grooves from wood. They are rarely used nowadays because these tasks are easily done using a router and specialist bits.



Rebates and plough groove

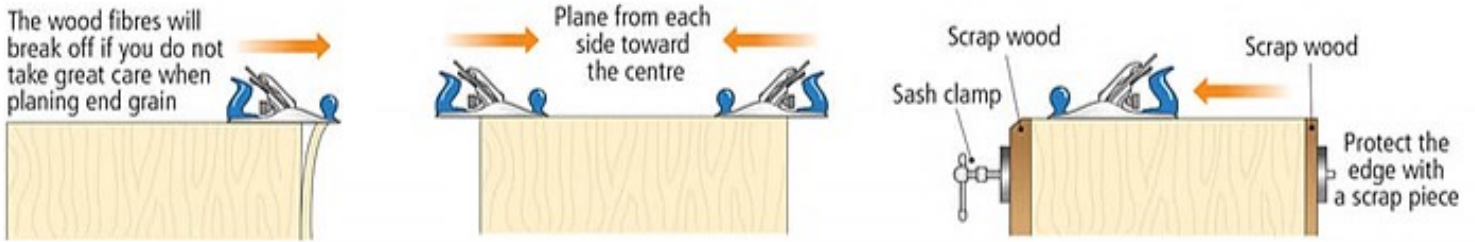


Rebate plane



### Planing end grain

It is important that end grain is finished smooth. When planing end grain, the fibres of the wood can splinter or tear at the edge. Care must be taken to avoid this. The diagrams below show ways that end grain can be successfully planed.

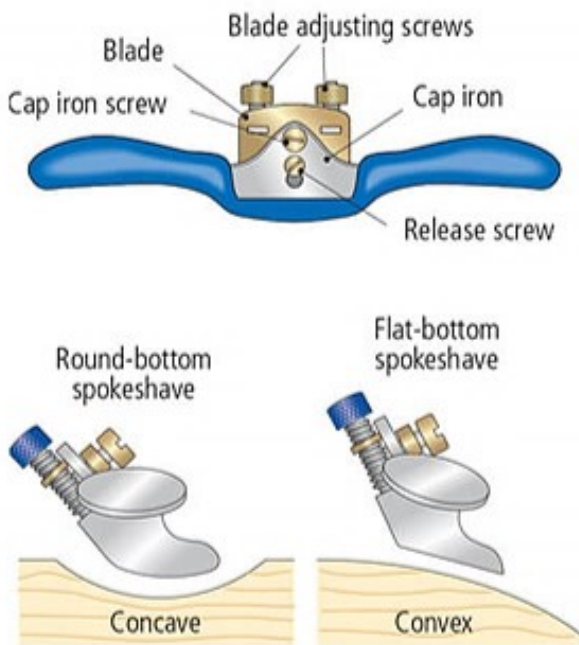


Planing end grain

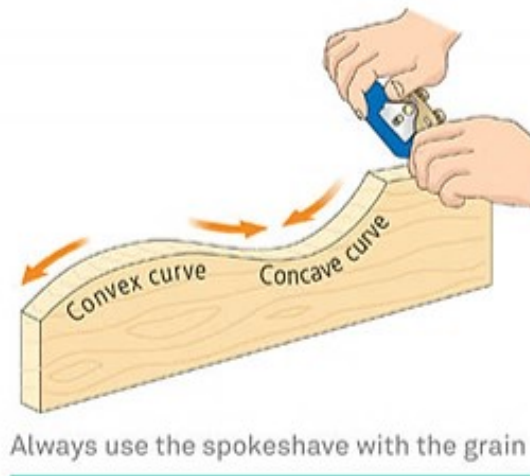
### Spokeshaves

**Spokeshaves** are designed for smoothing and shaping curved surfaces. They have a blade that is fixed in position with a locking cap and screw. There are two types.

Convex	Concave
<ul style="list-style-type: none"> <li>• has a flat base</li> <li>• used for flat surface or convex curves</li> </ul>	<ul style="list-style-type: none"> <li>• has a curved base</li> <li>• used on concave curves</li> </ul>



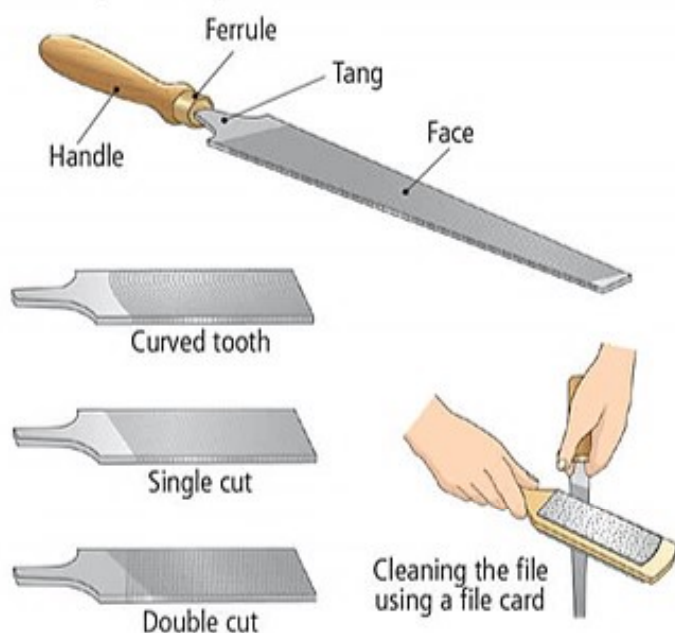
Types of spokeshave



## Shaping tools

### Files and rasps

**Files** and **rasps** may look very similar to each other, but they are not used for the same purposes. Notice how rasps have larger teeth than files. Used for rough shaping and sculpting of wood, rasps leave a rough surface that must be cleaned and sanded. Files, on the other hand, have fine teeth that are used on plastics and metals. There are a variety of shapes available.



Parts of a file

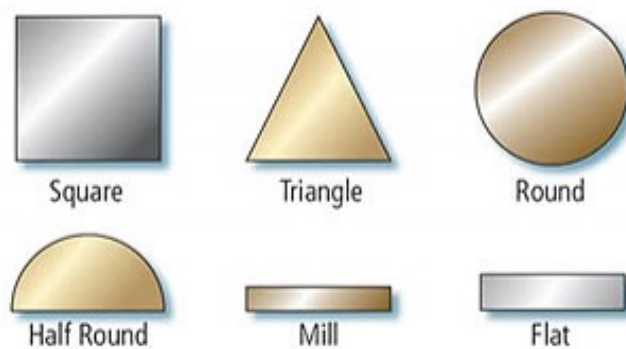
Files are cleaned with a fine wire brush called a file card.

### Surform (shapers)

Surforms are rough shaping tools. They come with different shaped blades to suit particular tasks. The blades are simply replaced when blunt or damaged.



Files and rasps



File shapes



Surform tools



## Screwdrivers

Screwdrivers come in a variety of shapes, sizes, and types to fit various screws. Common types are shown below.



Common types of screw found in the wood technology room

It is easy to damage the head of a screw if the correct type and size of screwdriver is not used. Over-tightening can also damage the head of the screw.

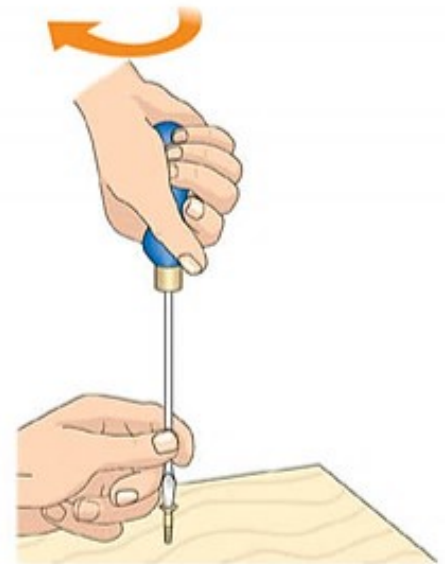


Why is the correct size screwdriver always used?

⚠ Always hold a screwdriver with both hands.



Screwdrivers. Why are they so different?



What type of force is being used here?

## Using the force

Consider what type of force you are using when driving a screw.

### Driving a screw

A pilot hole should always be prepared before driving a screw. A pilot hole makes it easier to fit the screw and prevents excessive force from being used and also prevents the wood from splitting. Pilot holes are especially important for hardwoods.



- 1 Bore a hole to take the shank of the screw
- 2 Bore a hole smaller than the thread of the screw
- 3 Countersink the hole with a countersink bit
- 4 Insert the screw

Steps in drilling a pilot hole for a screw

## Cramps

In the Wood Technology room, there are a variety of **cramps**. Long sash cramps are for gluing wide boards and projects while smaller g-cramps and quick release cramps are used for securing material firmly on the bench and for holding pieces in place with pressure while glue sets.



Types of cramp



## CHAPTER QUESTIONS

1 Give the name and function/use for each of the following tools pictured.

				
Name				
Use				
				
Name				
Use				

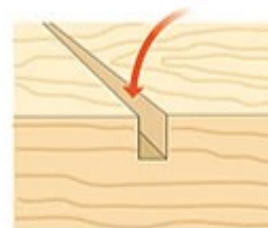
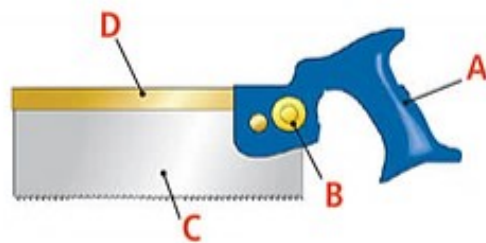
2 Describe what safety precautions you would follow when:

- pairing a trench with a chisel
- carrying a chisel across a room
- using a marking knife

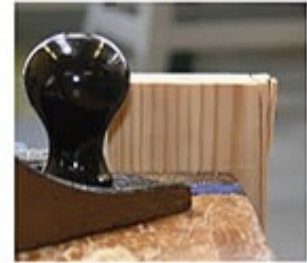
3 Name the parts of the saw shown in the diagram.

4 Describe the function of the parts in the saw pictured right.

5 What is the groove made by the cutting action of the saw (right) known as?



**6** What causes the wood fibres to split away from the wood when planing end grain as shown in the photo?



**7** Name the planes shown below and give a brief outline of where they are used.



(a)



(b)



(c)

**8** (a) What is the claw of the hammer shown in the sketch used for?

(b) Name another type of hammer used in the Wood Technology room.



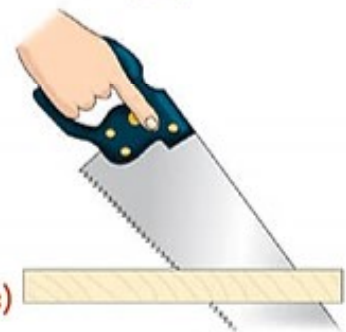
**9** State the correct names for the saws labelled A, B, and C below and give one appropriate use for each.



(a)

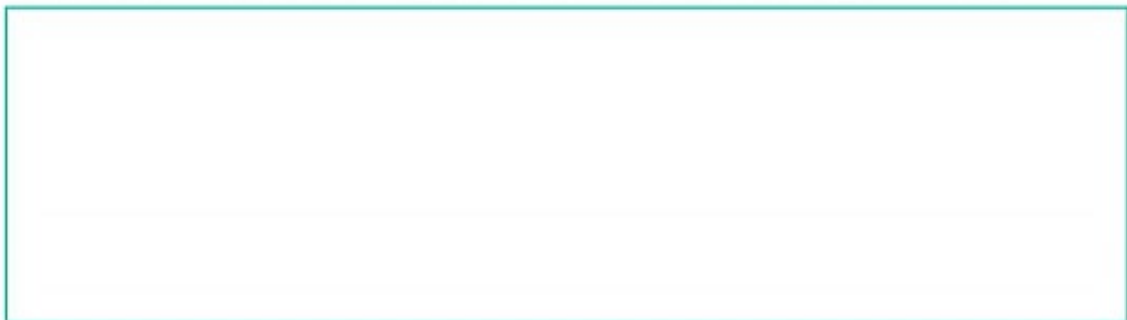


(b)



(c)

**10** Draw a sketch to show a thumb gauge and describe what it is used for.



PowerPoint Summary



Weblinks