National Certificate in Building, Construction and Allied Trades Skills (BCATS)

Identify, select, maintain and use hand tools for BCATS projects

Unit Standard – 12927

Level 2, Credit 6

Name: _____

Contents

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What you need to do

By the end of this module, you should be able to:

- identify, describe and select hand tools for construction projects;
- use hand tools for construction projects; and
- maintain hand tools for construction projects.

How you will be assessed

You will be assessed by a combination of practical, oral and written work.

To achieve this unit standard, you need to complete 3 construction projects where you can identify, describe, select, use and maintain hand tools. Your teacher/tutor will tell you which project(s) to complete.

You need to show your teacher/tutor that you can:

- describe what tools can and cannot be used for;
- describe how to use tools and how to do this safely;
- choose the right tool for the job;
- use tools correctly and safely;
- grind and/or sharpen cutting edges;
- keep tools clean and free of rust, and store and maintain them correctly; and
- report any damaged, blunt or faulty tools to your teacher/tutor.

Your teacher will give you an Assessment Record sheet for hand tools so you can record the tools you use on your projects, how you use them correctly, safely and how you maintain them.

Your teacher/tutor will also give you a worksheet that you need to complete and may ask you questions. Your teacher/tutor will mark these.

Glossary of Terms

Term	Meaning
Bevel	The slanted end of a tool blade that can be honed to produce a sharp edge for cutting
Blueing	The discolouration of a cutting blade as a result of overheating during the grinding process and indicating a loss of hardness in the metal
Burr	The rough or sharp edge of a cutting blade formed as a result of the sharpening process
Chamfer	A narrow flat surface at the corner of a piece of timber
Concave	Curving inward and having the shape of the inside of a sphere
Convex	Curving outward and having the shape of the external surface of a sphere
Countersink	To enlarge the upper part of a hole to allow the head of a screw to finish below the surface of the work
Cupped	Hollowed
Ferrule	The metal band that protects the end of a wooden chisel handle from damage when struck by a hammer
Grinding angle	The angle on the cutting edge of a plane or chisel. Usually between 20 and 25 degrees
Honing angle	The angle used to produce a sharp cutting edge. Usually 5 degrees greater than the grinding angle.
Impelling	The driving force used to propel a cutting tool forward
Knurled	A section of fine ridges on a tool that provide grip
Mushrooming	The distortion of the end of a metal tool as a result of being struck with a hammer
Serrated	Having a notched or saw toothed edge
Strop	The final stage of the sharpening process after honing
Torque	The twisting force that produces rotation

Classification

Hand tools can be classified according to their purpose.

Measuring, marking and setting out tools
Steel rule
Folding rule
Carpenter's pencil
Measuring tape
Try square
Combination square
Sliding bevel
Marking gauge
Cutting gauge
Spirit level
String line
Plumb bob

Cutting tools
Tenon saw
Dovetail saw
Panel saw
Cross cut saw
Rip saw
Coping saw
Hack saw
Chisel
Plane
Spokeshave
Scraper
Rasps and file
Sanding block

Impelling tools
Sledge hammer
Claw hammer
Warrington hammer
Nail punch
Mallet
Screwdriver

Gripping tools
Adjustable spanner
Pliers
Cramps
Pincers

Sharpening tools
Bench grinder
Motorised whetstone
Oilstone

Measuring, Marking and Setting out Tools

The ability to select and use the correct setting out tools and mark out accurately is an essential skill for any construction project and will ensure that the finished product meets the job specifications.

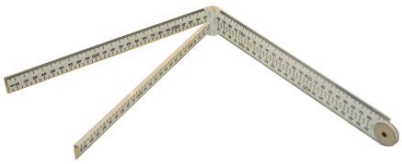
Steel rule

Stainless steel rule – common size 300mm long

Use	Care and maintenance
For accurate measuring and marking out, particularly for bench work and setting up machines. Maximum accuracy is achieved when used with a sharp marking knife or sharp pencil.	Protect the edges and ends from damage. Keep clean.

Folding rule

A folding, 1-metre rule graduated in millimetres.



Use	Care and maintenance
For accurate measuring and marking out. Use flat for an approximate reading; use on its edge to accurately mark measurements with a sharp pencil.	Easily broken. Lubricate hinges and keep the ruler clean.

Carpenter's pencil

The carpenter's pencil has a rectangular shaped lead and comes in hard, medium or soft grades.

Use	Care and maintenance
For marking and recording measurements. Use as a finger gauge for drawing lines parallel to an edge.	Keep the point sharp and chisel shaped.

Measuring tape

A flexible strip of steel divided into millimetres, centimetres and metres. Common lengths used by carpenters are 5m and 8m.

Use

To accurately measure lengths

When measuring, hold the tape tight and support it to prevent sagging.

Rewind after use.

Care and maintenance

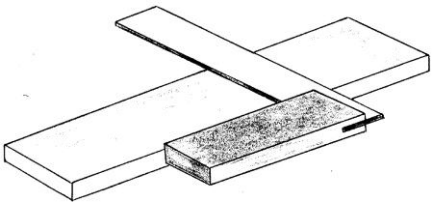
Avoid loops in the tape as they may cause it to snap when it is pulled tight.

It's important to keep the tape dry, lightly oiled and free from grit that may scratch the enamel surface and make reading and rewinding difficult.

Avoid retracting the tape hard onto the stop end.

Try square

A blade fixed at 90 degrees to the stock.



Use

For marking angles of 90 degrees.

Test if edges and corners are square.

Care and maintenance

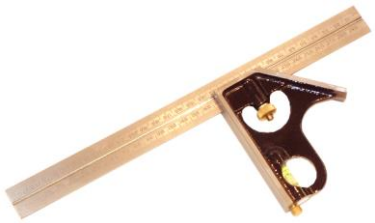
Keep clean and free of rust.

Ensure that squares are not knocked or damaged.

Note: *To test a square for accuracy, hold the stock firmly against the straight edge of a board and with a sharp pencil mark a fine line along the blade. Rotate the stock 180 degrees and against the same edge check the position of the pencil line. If the edge of the blade does not line up with the line on the board it is not accurate.*

Combination square

The stock is adjustable and can be fixed by a thumb screw in any position along the blade.



Use

For marking angles of 45° and 90°.

Use as a gauge in awkward places and for measuring the depths of rebates.

Care and maintenance

Keep clean and free of rust.

Lightly oil the thread screw so the stock moves easily on the blade.

Sliding bevel

The blade is held in position on the stock by a thumbscrew. The blade of the bevel can be adjusted to any desired angle.

Use

For marking odd angles and testing bevel cuts and mitres.

Care and maintenance

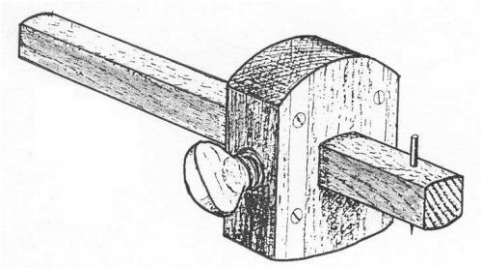
Keep clean.

Lightly oil thread at thumbscrew to keep moving parts in operating order.

Retract blade when storing.

Marking gauge

The spur scribes the line and is mounted in the stem. Move the position of the stock on the stem to adjust. The thumbscrew locks the gauge in a set position.



Use

For scribing lines parallel to an edge.

Care and maintenance

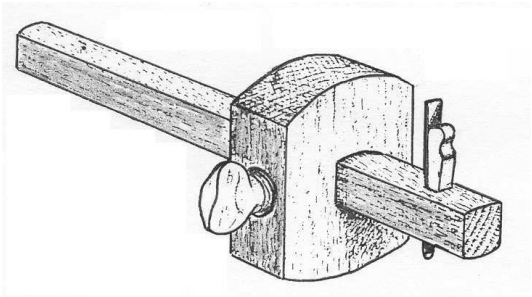
Keep the spur sharp.

Release the tension on the thumb screw when not in use.

Store in a clean and dry environment.

Cutting gauge

A cutting gauge is similar to the marking gauge but with a cutter or blade instead of a spur.



Use

For cutting or marking out across the grain.

Used for cutting veneer or thin timber into strips.

Care and maintenance

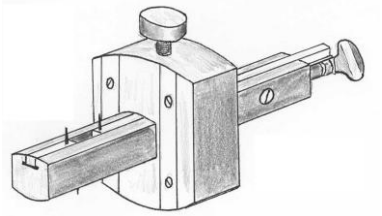
Keep the cutter sharp.

Release the tension on the thumb screw when not in use.

Store in a clean and dry environment.

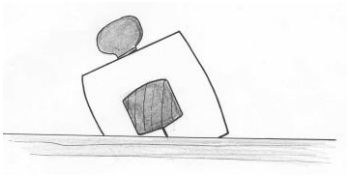
Mortise gauge

The mortise gauge has two spurs, one of which is adjustable and used to mark two lines parallel to a face or an edge. This gauge is particularly useful for marking out mortise and tenon joints as well as positioning for dowel joints.

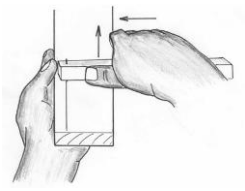


Gauges – accurate setting up and use

- Setting up – adjust the stock to the correct distance from the spur with the aid of a rule.
- Gently tighten the thumbscrew to lock the stock in place.
- Make fine adjustments by lightly tapping the end of the stem against the bench.
- When it is correctly set, firmly tighten the thumbscrew.
- Place the stock firmly against the edge of the work.
- Slide the gauge along the edge with the spurs dragging on the surface to leave the required mark.



Roll the gauge over until the spur is dragging on the work.



Keep the stock held in firmly against the edge to ensure a parallel line.

Spirit level

Spirit levels are made of either wood or metal and can have up to 6 level tubes or vials. They are available in varying lengths.

Use	Care and maintenance
For testing that horizontal and vertical surfaces are level or plumb. Level is indicated when the bubble is between the lines in the centre of the liquid vial. Some levels have a digital display with accuracy to within one-tenth of a degree.	Treat carefully. Do not drop or knock. Keep clean.

Note: *Check accuracy by placing the level on fixed points, read the vial, and then turn the level end for end. If the reading in the vial is the same, the level is accurate. If not, the level needs to be adjusted.*

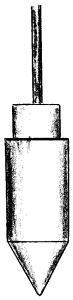
String line

String lines have a nylon line wound on a timber or plastic dowel. They are available in various lengths, such as 50m or 100m.

Use	Care and maintenance
To set out straight lines; for example, for foundations and wall frames. Must be pulled tight for accurate alignment.	Keep string free of knots. Rewind onto dowel when not in use. Continual use may cause the first section of line to deteriorate. Cut off if necessary.

Plumb bob

Plumb bobs have a metal weight or "bob" which is usually pointed and suspended on a string. The bob reduces the effects of wind when checking for vertical level (plumb).



Use	Care and maintenance
Testing that vertical surfaces are true. In strong winds, suspend the 'bob' in a bucket of water to achieve a stable reading.	Ensure that the string is in good condition and is free of knots. Rewind onto dowel when not in use.

Activity 1

Describe the damage caused by unrestrained retention of retracting a measuring tape into its case.

Describe the effect of a sagging tape on the measurement.

Plumb bob – What is the purpose of placing the "bob" into a bucket of water when using it in high winds?

Cutting Tools

Saws – General comments

A well-balanced handsaw is an essential item for any woodworker. While portable circular saws have, in many cases, superseded hand saws, a properly sharpened and set saw can produce a smooth, straight cut with greater accuracy than a power saw.

Hand saws vary in size and shape to suit particular jobs. The three main groups are:

- backed saws, such as tenon saws and dovetail saws;
- rip, crosscut and panel saws; and
- curve cutting saws, such as coping saws.

The number of teeth per 25 mm gives the size of the saw.

Safety

Teeth should be kept sharp. Dull teeth cause the saw blade to slip, stick or skip and can cause injuries. A sharp saw will cut most timbers easily; however, a saw that is always jamming in the cut probably needs resetting.

Take special care when using your thumb as a guide to start the saw cut.

Care

Before you cut any timber, ensure that it is free from nails, stones or any items that can blunt or damage the teeth.

- Lightly oil the blade to protect from rust.
- Use a blade guard to protect the teeth when not in use or place the saw in a rack or a saw bag.
- Send to a saw doctor for sharpening and setting when required.
- Ensure that the blade is not ***bent.***

Tenon saw

The tenon saw has a brass or steel ridge on the top edge to strengthen and stiffen the blade. Blade lengths vary from 300 to 400mm, with 13 points per 25mm.

Use	Care and maintenance
For general bench work, e.g. when a fine cut is required on small items, such as mouldings. Can also be used in a mitre box for consistency and improved accuracy.	Store in a rack or hang by the handle or blade. Keep clean and free of rust. Maintain the saw in a sharp condition.

Dovetail saws *are smaller versions of the tenon saw, with 18 to -22 teeth per 25 mm. The dovetail saw is used for cutting dovetails and other fine work.*

Panel saw

Panel saws are normally 600mm long or shorter, with 10 to 12 points per 25mm.

Use	Care and maintenance
For fine crosscutting on finishing timber and panels.	Store in a rack or hang by the handle or blade Keep clean and free of rust.

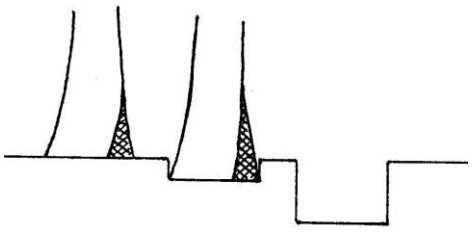
Crosscut saw

Crosscut saws are normally 700mm long, with 5 to10 points per 25mm.

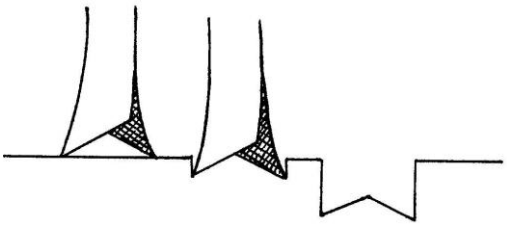
Use	Care and maintenance
For general-purpose cutting across the grain of timber.	Hang by the handle or blade. Keep clean and free of rust. Send to saw doctor for sharpening and setting when required.

Rip saw

Rip saws re normally 700 to 800mm long, with 3 to 6 points per 25mm.



Rip saws cut along the grain with a ***chiselling*** *action.*



Crosscut cuts the wood fibres with a ***slicing*** *cut.*

Note: *Ripping timber along the grain is now usually done either with a portable power saw or on a saw bench.*

Disposable or hardened toothed saws

Over recent years the use of cheap, disposable multi-purpose hand saws has increased in popularity. These saws are mass produced and many are specifically designed to be used for both cross cutting and ripping purposes.

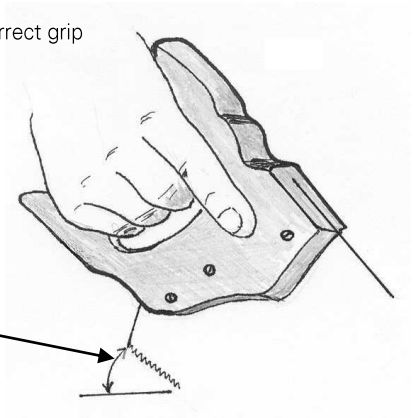
When purchasing these saws, their intended purpose (i.e. cross cutting or ripping) should still be considered.

The blades of these saws are manufactured from hardened steel and therefore are unable to be sharpened once the teeth have become blunt. Therefore it is important that once they come to the end of their useful life they are disposed of responsibly.

Correct use

- Stand over the cut.
- Grip the handle with the index finger pointing forwards on the handle, to steady and control the saw. (Refer to diagram below)
- Use the thumb of the other hand to position the blade, as the saw is upwards to start the cut.
- Start sawing on the waste side of the line.
- Stand over the blade so that both sides of the blade can be seen at the same time. This will ensure that a square cut is produced.
- When the cut is almost complete, the waste wood must be supported to prevent it from breaking off.
- The saw should be held at an angle of about 60 degrees for ripping and about 45 degrees for crosscutting.

The correct grip

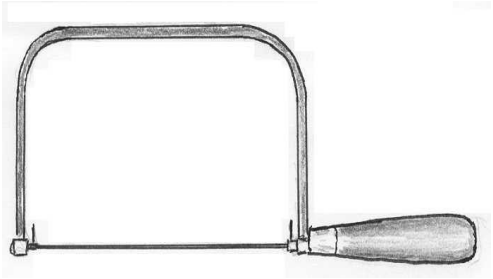


Cutting angles –

– 45 degrees for crosscutting
– 60 degrees for ripping

Coping saws

Coping saws have a fine blade held in tension in an adjustable steel frame. Two adjustable levers alter the blade position.



Use	Care and maintenance
For cutting sharp curves in thin timber. Scribing the ends of mouldings at internal angles.	Replace the blade when necessary. Keep clean and free of rust. Align the adjustable pins to ensure that the blade is straight within the frame. A twisted blade will produce a rough, inaccurate cut and is more likely to break.

Hack Saws

Blade lengths vary from 225 to 305mm, with 18, 24 or 32 teeth per 25mm. Hack saws have a detachable blade held in a heavy duty metal frame. The blade is held under tension to help prevent it twisting and bending

Use	Care and maintenance
For cutting metal or plastic. For softer material, generally use a coarser blade.	Release blade tension when storing Keep clean and free of rust.

Activity 2

1. **a)** A hand saw repeatedly jams during use. Explain the likely cause of this.

b) What needs to be done to fix this problem?

2. At what angle should a rip saw be held when ripping timber?

_____ degrees.

3. At approximately what angle should a saw be held when crosscutting timber?

_____ degrees.

4. You should keep the blade of the coping saw straight by lining up the sighting pins. What could happen if the blade is twisted?

5. **a)** Identify 2 situations when a hand saw would be the quicker and easier to use than a portable electric circular saw.

b) Explain why.

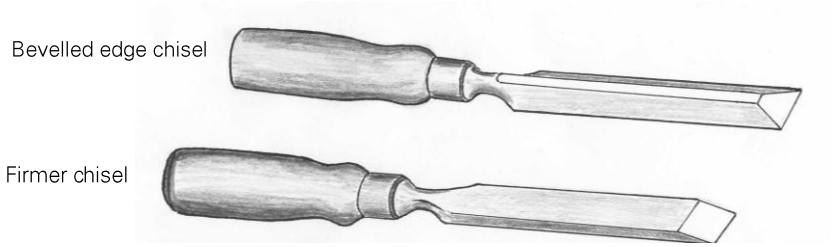
Chisels

There is a wide range of chisels available and designed for many different purposes. A set of the standard size bevel-edged type is suitable for most construction work.

Modern chisels with shatter-resistant plastic handles are able to withstand being repeatedly struck with a steel hammer. It is important that only a wood mallet is used on the traditional wooden handled chisels.

A chisel consists of a tempered steel blade and a shaped plastic or wooden handle. One end of the blade is ground and sharpened to produce a cutting edge while the other end has a sharpened tang which fits into the handle. The blades are heat treated to ensure that they retain a fine cutting edge. Chisel widths vary from 6 to 50mm. The bevelled edged and firmer chisels are most commonly used.

Other chisels available include butt, registered firmer, parring and carving chisels



Uses

Chisels have a wide range of applications in the construction industry

Fine, delicate cutting including checking out hinges, forming and levelling joints.

Shaping and trimming timber.

Care and maintenance

Keep clean and free of rust.

Keep the cutting edge sharp.

Do not use excessive force when driving with a hammer or using a levering action which could bend or break the blade.

Store in a rack, roll up pouch or carrying case.

Safety rules for chisels

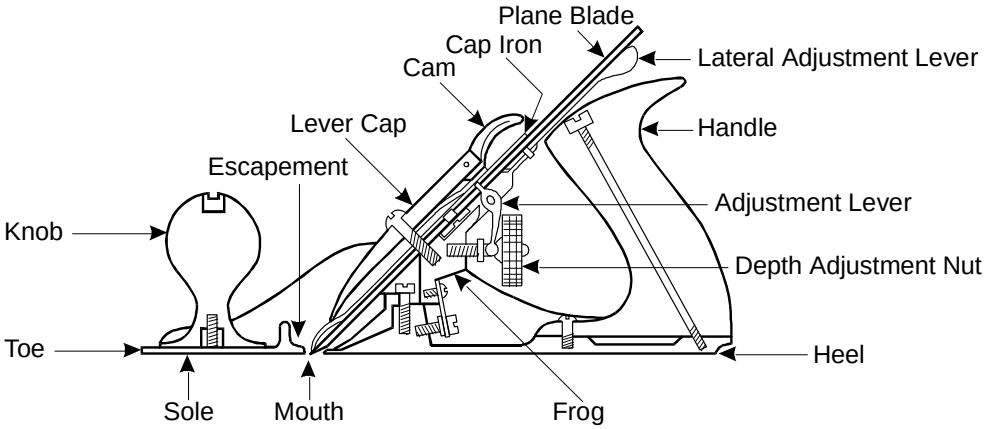
- *Keep chisels sharp.*
- *Keep both hands behind the cutting edge.*
- *Ensure that all work is securely fastened down.*
- *Maintain control of the chisel at all times.*
- *Carry the chisel with the blade pointing downwards.*

Planes

There are a number of different types of planes available. The most common of these are:

- smoothing plane;
- jack or bench plane;
- rebate plane; and
- block plane.

Metal planes vary in size, with the most common size being 245 x 50mm (No 4) and have a cast steel body and a steel blade attached to a cap iron and held firmly in place with a lever cap. The blade can be adjusted in two directions using a lever and a wheel adjustment.



Use	Care and maintenance
To produce smooth timber surfaces, straighten timber, and reduce timber to the required width.	Keep clean and free from rust by applying a light coat of oil. Blades should be kept sharp and correctly set. Always store a plane on its side to protect the cutting edge of the blade when not in use. Do not knock or drop the plane. Retract blade from the cutting position when not in use.

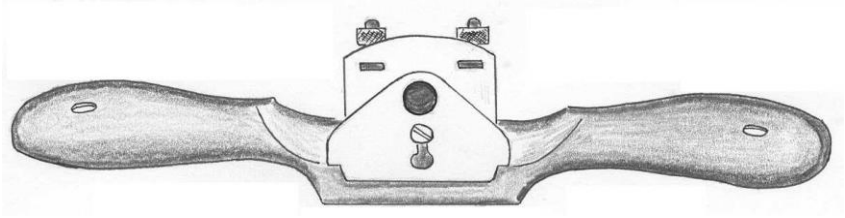
Safety: *Ensure that the work is securely fastened down before planing.*

Selection and use

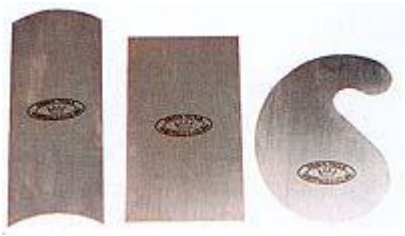
- A smoothing plane is intended mainly for smoothing and finishing work, but it can also be used for cleaning up end grain, chamfers and rounding edges. Because of its relatively short length, it should not be used for planing long lengths of timber, as its sole will follow the shape of the surface.
- A jack plane has a longer sole for planing longer lengths of timber, taking off the high spots to create a straight, flat surface.
- Jointer or try planes have a very long sole and were used for planing long, straight edges or surfaces. Mechanised portable electric planers have largely superseded them.
- Small block planes are used for fine chamfers and planing end grain.
- There is quite a range. Many of the edge-shaping and specialist planes have been superseded by modern power tools, such as electric routers, e.g. fillister, combination, rabbet and router planes. Wooden planes have been largely replaced by metal planes.

Spokeshaves

A spoke shave is used for smoothing surfaces on internal or external curves. The cutting action is similar to that of a plane, but the sole is short so that it will follow the curve of the component. The sole face can either be flat or curved, with the curved sole being more suitable for concave curves. The care and maintenance is the same as for planes, although spoke shaves are likely to break when dropped.

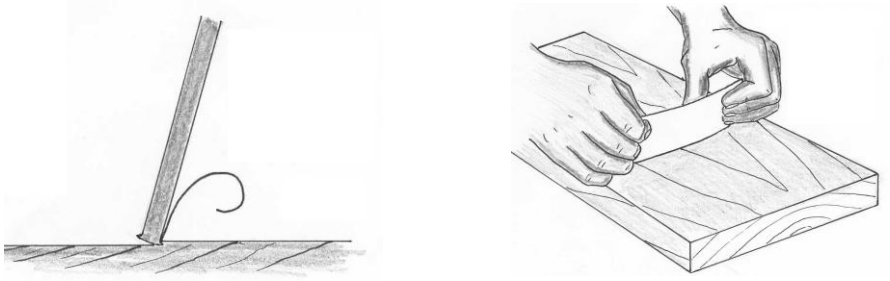


Scraper



The hand scraper is usually a flat piece of steel, with the cutting edge being formed by burring over the long edges of the scraper. It is used to remove marks and defects on the planed surfaces and is particularly effective on irregular or opposing grains. Scrapers can be also shaped up for use on curved surfaces.

Use: Hold the scraper in both hands, with your thumbs behind the blade. Lean the scraper forwards until it begins to cut. Push the scraper along the grain, bending it slightly so that it forms a curved cutting edge; this prevents the corners from digging in.

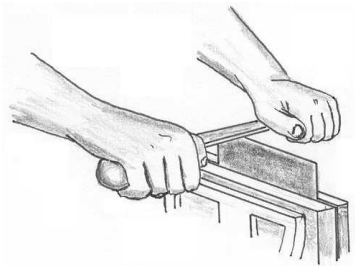


Use at an angle of approximately 85 degrees

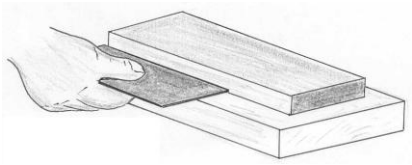
Care and Maintenance: Handle your scraper carefully so as not to damage the cutting edge. When you put it down, use a piece of timber, and hang the cutting edge over the edge of the timber.

Sharp scrapers produce fine shavings, blunt or dull edges just produce ***dust***. The following processes detail the stages involved in sharpening a scraper.

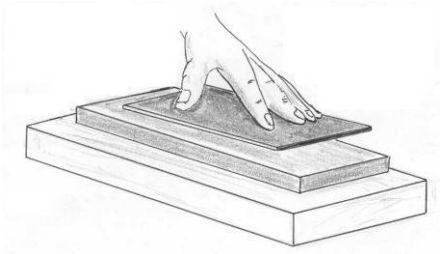
Scraper sharpening



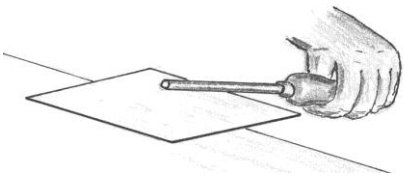
File the edges straight and square by draw filing with a smooth mill file. Round the corners slightly.



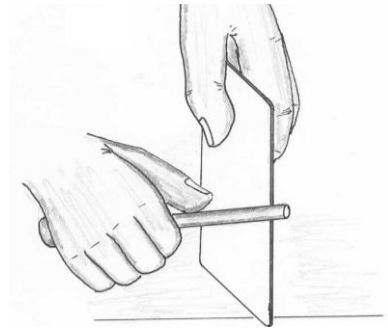
Remove the file marks using either the edge or face of an oilstone. Using the edge provides the option of using the oilstone's box for support to ensure a square edge.



Remove the burr by laying the scraper flat on the oilstone. The edges should be very smooth and sharp.



Raise the burr. Move the scraper so that it overhangs the edge of the bench. Holding the burnisher at a slight angle, draw it along the edge of the scraper.



To turn the *burr* over, hold the scraper on its end. With the burnisher approximately 90 degrees to the face for the first stroke and 85 degrees for the rest, make two or three firm strokes.

Stroke 1 - 90° to face

Stroke 2 - 85° to face

Note: When the cutter loses its edge, raise a new burr using the burnisher. There is no need to square the edge again, until it is rounded or damaged.

Sharpening cutting tools

A sharp cutting edge can be produced on a plane cutting iron or chisel by:

- using a grinder to shape the edge;
- using an oilstone to sharpen or hone the cutting edge; and
- stropping the edge to remove the burr.

Grinding does not produce a fine enough edge, so the ground edge must be sharpened on an oilstone. Sharpening, or honing, is done more often than grinding.

Grinding equipment

Bench grinder

The bench grinder is a tool used to grind steel cutting tools to repair a cutting edge that has been damaged or is in need of repair.

A portable bench grinder is used primarily for sharpening cutting tools such as:

- hand tools – planes, chisels etc;
- twist drills;
- hand-held construction equipment; and
- can also be used for removing excess metal or material, and the rough shaping of parts.

Safety

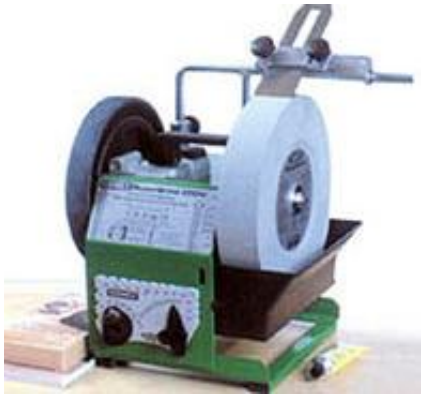
- Always wear eye protection when working on or near a grinder.
- Always allow the bench grinder to reach full operating speed before starting the grinding process.
- Do not apply the work to the grinding wheel after the power has been turned off.
- Do not wear gloves, loose clothing or items that could catch on the wheel and cause injury to operator.
- Before starting work check that the grinder is firmly fixed to the bench, there are no chips or cracks in the wheels, and they are securely attached to the grinder.
- Ensure that all guards and guides are in place and the transparent safety shield is set in the correct position.
- Grind only steel, as other materials will clog up the wheel, causing the wheel to possibly explode.
- Do not use the side of the wheel as this may lead to the wheel shattering in use.
- Keep the adjustable work rest within 2mm of the wheel.
- Make a habit of standing to one side of the grinder when starting the machine and until it has reached its full operating speed.

Motorised whetstone

A slow turning motorised stone lubricated by water that helps prevent overheating when in use.

It is slower cutting than a bench grinder but safer and easier to use.

The water also helps to maintain a clean cutting surface.



Oilstone

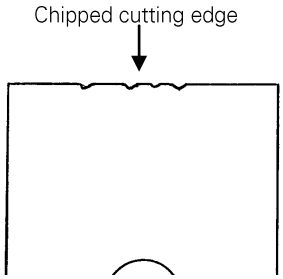
- An oilstone is used to hone the blade to produce a very sharp, cutting edge.
- To prevent clogging, and to help the blade being sharpened slide across surface of the oilstone more easily, the surface of the oilstone is lubricated with a light film of oil.
- Move the blade over the surface of the oilstone in a figure 8 pattern to ensure even wear of the face. This practice avoids creating dips and hollows.
- A dirty or clogged oilstone can be cleaned with kerosene to restore its cutting edge.
- Store your oilstone in a clean and dry place, preferably in a box, to protect it from damage.
- Never drop an oilstone. They are very fragile and break easily.

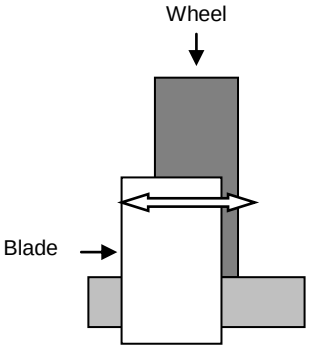
Sharpening chisels and plane blades

Chisels and plane blades require the same sharpening method.

1. Grinding

Grind the blade back until the chip has been removed.

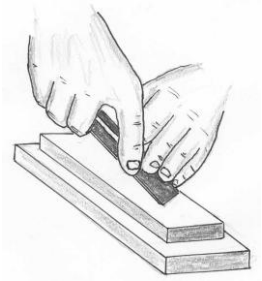




Move the blade from side to side across the face of the grinding wheel. The bevel is hollow ground at an angle of 20 to 25 degrees.

2. Honing

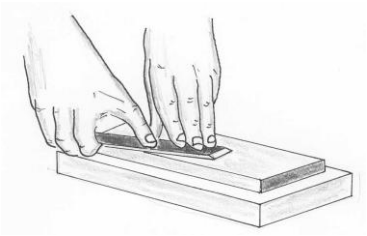
When a slight burr appears on the back of the blade, turn the blade over and place flat on the stone. Rub along the stone to remove the burr.



Hone or sharpen the blade at a 25 to 30 degree angle.

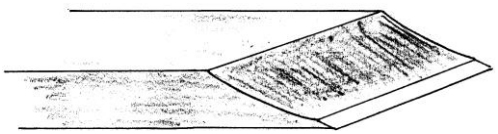
Place the blade with the grinding bevel flat on the oilstone and tilt slightly to create the sharpening angle.

Move the blade back and forth in a figure 8 motion, covering the full length of the stone. This will help prevent the stone from developing dips and hollows.



3. Stropping

To produce a really sharp edge, the blade is stropped on a leather strop, to remove any remains of the burr. The finished chisel will be razor sharp.



Note the hollow ground bevel of 20- 25 degrees and the honed edge of 25- 30 degrees.

Other cutting or finishing tools

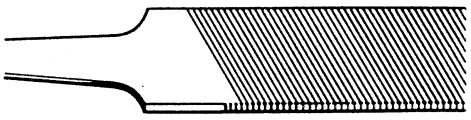
Rasps and Files

Rasps are used to rough out the shape or smooth the edges of wood and are generally used in a freehand manner. The shape of the rasp can be flat, round or have a half-round profile.

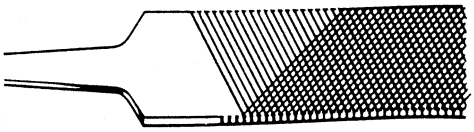
Files have a finer cutting edge than a rasp and are used to clean up edges and to reduce the size or shape of a range of materials. Files come in a range of profiles and cutting surfaces according to the task they are designed for.

To avoid serious injury to the wrist, never use a file without a handle.

Single cut files are used for cutting hard metals, e.g. knives and saws. They have an unbroken series of cuts, parallel with each other but running at an angle to the length of the file.



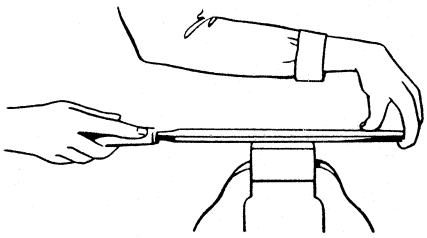
Double cut files are used for general purposes. They have two series of cuts running diagonally across each other, one series being finer than the other. The double cut file is used with a heavier pressure than the single cut and removes material work piece faster.



The two most common methods of using a file are:

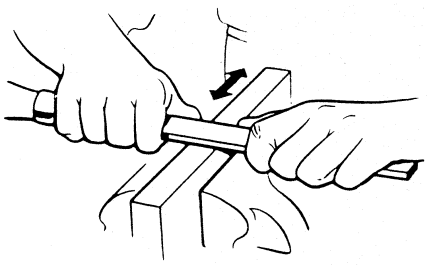
Straight filing

This consists of pushing the file lengthwise – straight ahead or slightly diagonally – across the work piece.



Draw filing

This consists of grasping the file at both ends and pushing and pulling it across the work.



Sanding block

Sanding blocks are usually blocks of compressed cork, rubber or a similar soft material and are used to provide a firm base for the abrasive paper as it is pushed back and forth along the surface being prepared for finishing.

Use

Cut a piece of abrasive paper to the same length as the block, and twice its width. Wrap the paper tightly around the block and commence sanding along the grain. A fine dust should be produced.

Safety

Work in an adequately ventilated area or wear a suitable dust mask to protect you from inhaling the dust.

Note: *sanding with the aid of a block will give a flatter, more even finish than can be achieved by holding the paper in the hand. Without a block the uneven pressure from individual fingers will result in dips and hollows in the surface of the timber.*

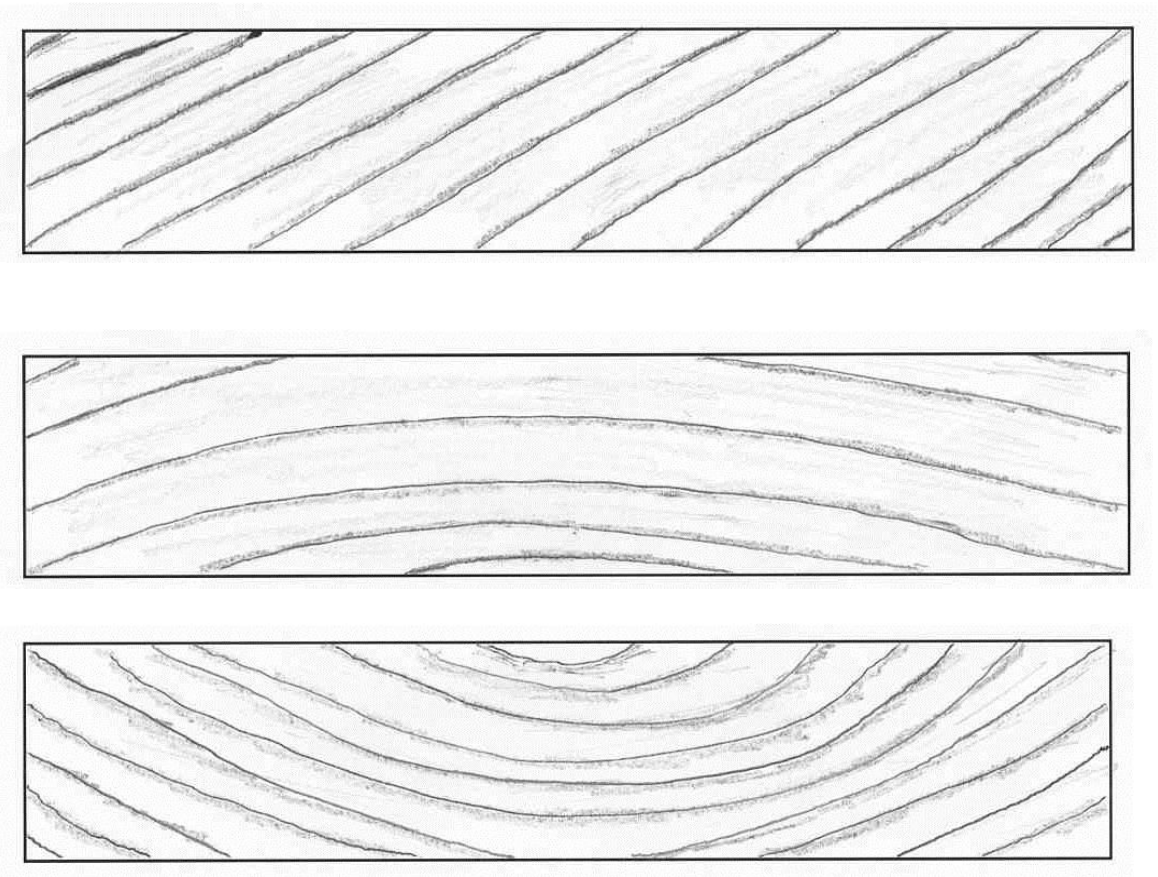
Activity 3

1. Word match – match the parts from the list below with the correct definition.

Lateral adjusting lever, Adjusting nut or wheel, Lever cap, Heel, Plane blade or iron, Toe, Back or Cap iron

Definition	Part
Holds the cutter firmly in position by means of a locking cam and eliminates chatter.	
Curls the shavings over, preventing a tearing cut.	
High carbon steel holds the cutting edge.	
Permits sideways adjustments of the cutter.	
Regulates the thickness of the shavings.	
The leading edge of the plane.	
The back of the plane.	

2. Planing in the direction of the grain provides the smoothest finish. On the range of grain patterns below use arrows to indicate the planing direction that would achieve the finish.



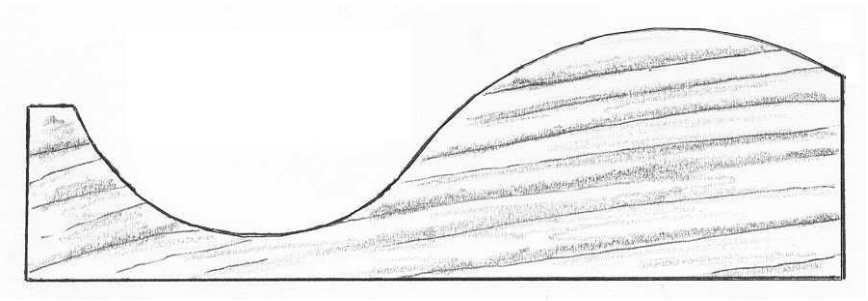
3. When planing the edge of a board you notice that your cut is not square to the face of the board. What needs to be adjusted on the plane to correct the problem?

4. A sharp blade is needed to achieve a fine cut. What other factors in the setting up of the plane will affect the quality of the cut?

5. What is the advantage of using a long plane over a short one when straightening the edge of a piece of timber?

6. Identify the tool or tools needed to smooth the curved surface of the timber shown below for Question 7.

7. On the sketch provided, indicate the direction of cut to get the smoothest finish.



8. During the process of sharpening a chisel on the grindstone, the edge turns a blue colour. What has caused this and what will be the effect on the tool?

Cause:

Effect on tool:

How could this have been prevented?

9. Do chisels need to be reground every time they become blunt?

10. What is the correct grinding angle for a plane or chisel blade?

11. What is the correct honing angle for a plane or chisel blade?

Impelling tools

There are many types of hammers and mallets used for woodworking and construction tasks and the appropriate tool should be identified, selected and used correctly.

Sledgehammers

Sledgehammers are used for driving pegs and stakes into the ground, and for demolition work. They come in a range of sizes and weights to suit job requirements.

Hammers

Hammers are available in a range of head and claw styles, shapes, weights and handle designs and lengths. The Claw hammer, which is used for construction, and the Warrington hammer, which is used for bench work, are the most commonly used types.

Use

For driving in and pulling out nails, and driving chisels and set punches.

Always strike securely to avoid glancing blows.

Use the appropriate hammer (considering head and claw design, weight and handle length) to suit the job and to suit your personal preference.

Care and maintenance

Clean the hammer face by rubbing it on a piece of fine sandpaper.

Maintain a clean handle

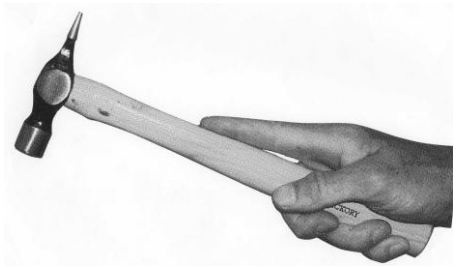
Never use a hammer with a handle or head that is loose or damaged.

Most personal hand tool injuries are caused by hammers. These include crushed fingers or eye injuries caused by projectiles that come off the face of the hammer.

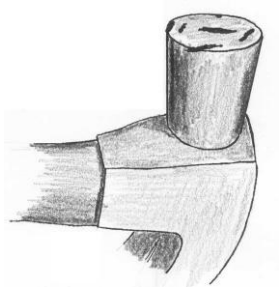
Safety precautions for hammers

- *Ensure that the face of the hammer is not chipped or damaged and is free from dirt, paint or grease.*
- *Check the handle for splits and ensure that the head is firmly attached to the handle.*
- *Do not use hammers with loose heads or chipped faces.*
- *Never strike with the side of the hammer.*
- *Never strike the face of one hammer with another.*

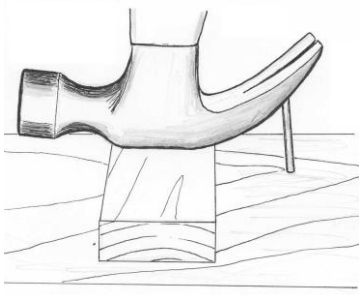
Hammer tips



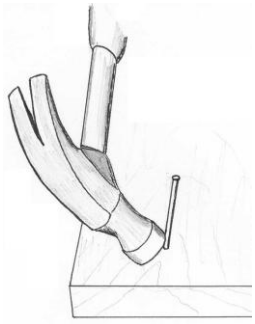
Correct grip



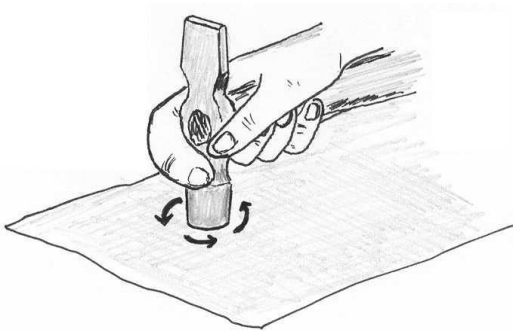
Striking the hammer against hardened objects will result in a chipped face.



Placing a piece of timber under the head gives you more leverage and prevents damage to the face of the work.



A dirty hammer face will result in the hammer slipping off the nail.

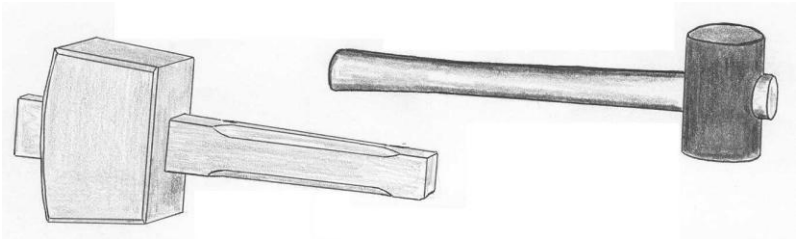


Clean the hammer face by rubbing it on a piece of fine sandpaper.

Note: *Never strike your work directly with the hammer or mallet. Use a piece of scrap wood to save your work from bruising or damage.*

Mallets

Mallet heads are made out of either hardwood or rubber fitted to a wooden handle.



Use

Mallets are used for striking chisels or assembling frames or carcasses.

Rubber headed mallets are generally used for carcass assembly. Because of their softer heads, you do not need to hold scrap timber against the job when using this mallet.

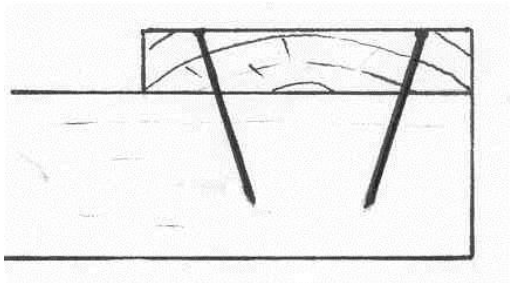
Care and maintenance

Do not use the mallet on steel or hard surfaces.

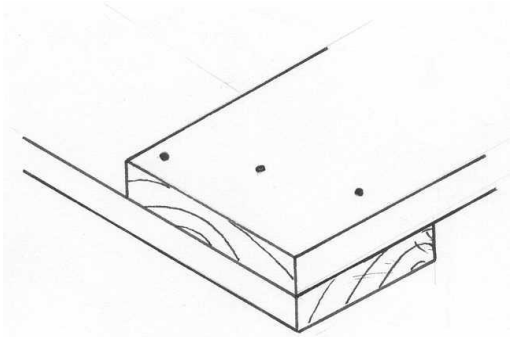
Check head faces and handles for splits or cracks.

Ensure that the head is securely attached to the handle.

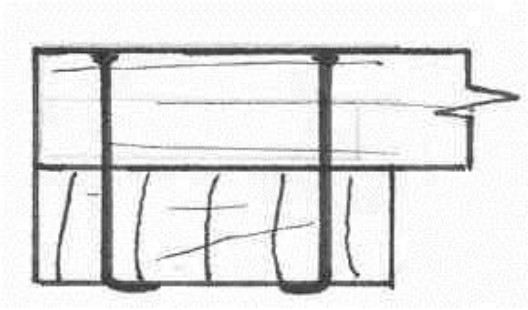
General hardware skills



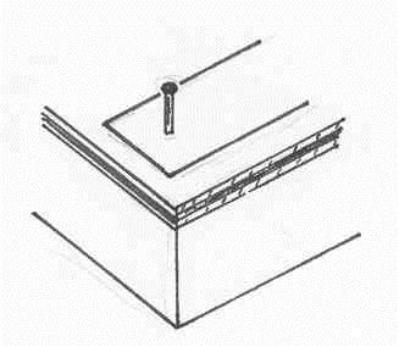
1. Select a nail that is between 2.5 and 3 times longer than the thickness of the wood being nailed. Dovetail nailing grips better than straight nailing, particularly in end grain.



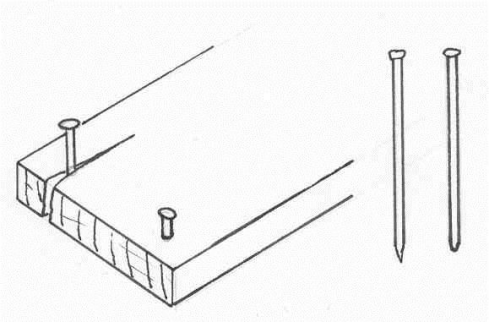
2. Stagger the nails across the grain. This will greatly reduce the risk of splitting.



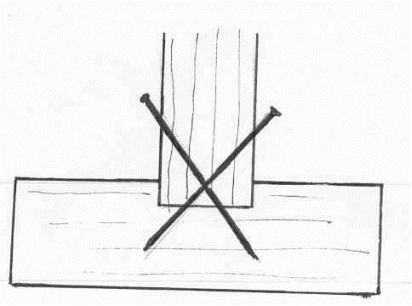
3. For maximum strength clinch the nails. Hammer through the board and bend ends over across the grain.



4. Hold small nails (panel pins) in position with a strip of cardboard to save striking fingers with hammer. Hammer the pin through the card and tear away.



5. To eliminate splitting, blunt the point of the nail before driving it into the timber. For nails close to the edge, drill a fine pilot hole. To avoid bruising the wood, stop driving the nail just above the surface and finish off with a nail punch.



6. Use skew nailing when two pieces of wood are to be joined at right angles. When driving the nails home, take care not to damage the wood.

Nail punch

Nail punches are manufactured from hardened steel with a knurled body for grip. They are available in varying tip sizes depending on the size of nail they will be setting.

The tip is cupped and chamfered for ease of alignment and to reduce slipping on the nail head.

Use

Nail punches are used to drive or set the head of the nail below the surface of the timber.

Grip the nail punch firmly or it may fly off when struck.

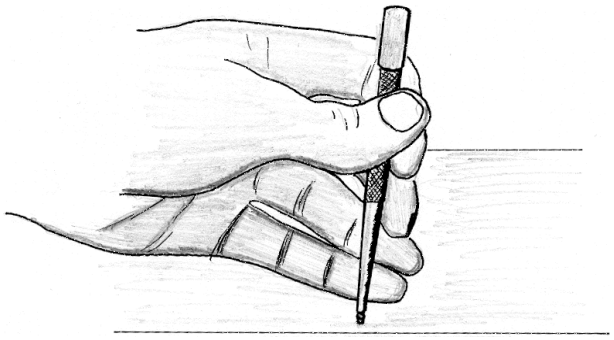
Make sure the correct size punch is used – the nail punch point should be slightly smaller than the nail head being punched.

Care and maintenance

Discard if the point becomes chipped or when the cupped point wears away.

Inspect the nail punch for damage. Any burrs that have formed on the head should be removed by grinding off.

Use a punch only for its proper purpose, i.e. punching nail heads.



When placing the nail punch on a nail head, stabilise with your little finger.

Hand drill

Hand drills have a steel frame, wooden handle, double pinion gears and a three jaw chuck. The normal chuck capacity is 6mm.

Use	Care and maintenance
For drilling small holes in wood and metal, in preparation for screws or nails, and for countersinking wood.	Keep clean and free of rust. Lightly oil crank, gear wheel and pinion with thin oil. Make sure drill bits and countersinking bits are sharp.

Twist drill bits

Twist drill bits are available in various sizes. The chuck size determines the maximum diameter drill bit that can be used. The normal diameter range used by carpenters is 1 to 13mm with a 1mm rise. Drill bits are available for masonry, metal and timber.

Use	Care and maintenance
With a drill for drilling holes in masonry, timber or metal.	Use the correct drill cutting speed to suit the drill bit and the material being drilled. Store in drill-set case when not in use. Sharpen when required.

Screwdriver

Screwdrivers are available in various sizes and to suit various screw head configurations.

Use

Use only for driving or withdrawing screws.

Select the appropriate size screwdriver to suit the screw head. Make sure the tip fits the slot of the screw.

Never use a screwdriver on a work piece held in your hand – a slip could cause serious injury.

Never depend on a screwdriver's handle or covered blade to provide insulation from mains electricity. Vinyl covered blades are intended only as a protective measure against shorting-out components.

Care and maintenance

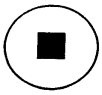
Keep clean and free of rust.

Do not use screwdrivers as levers as they may bend.

Never use a screwdriver as a cold chisel, or for prying, punching, chiselling or scraping.

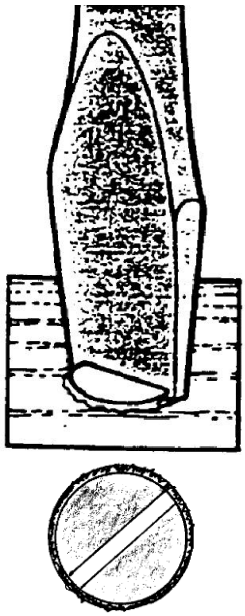
Check the blade to ensure that the end is not damaged or rounded over.

Common screw head configurations

	**Slotted**	Standard or flat for driving single slotted screws. Tip width range from 4.2mm to 12.5mm.
	**Phillips**	Designed specifically for use with a Phillips head screw, which has two recessed slots at right angles to each other. Sizes range from 0 point (small) to 4 point (large).
	**Pozidriv**	Similar to the Phillips style, the screw can be identified by additional lines on the face. Sizes range from 1 point (small) to 4 point (large).
	**Square drive**	Square tip, commonly used in industrial applications. Sizes range from 1 point (small) to 3 point (large).

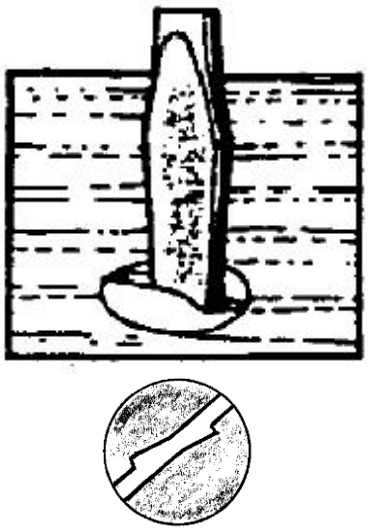
Incorrect use

Head too big



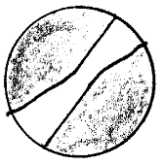
Oversized screwdriver scores the wood.

Head too small



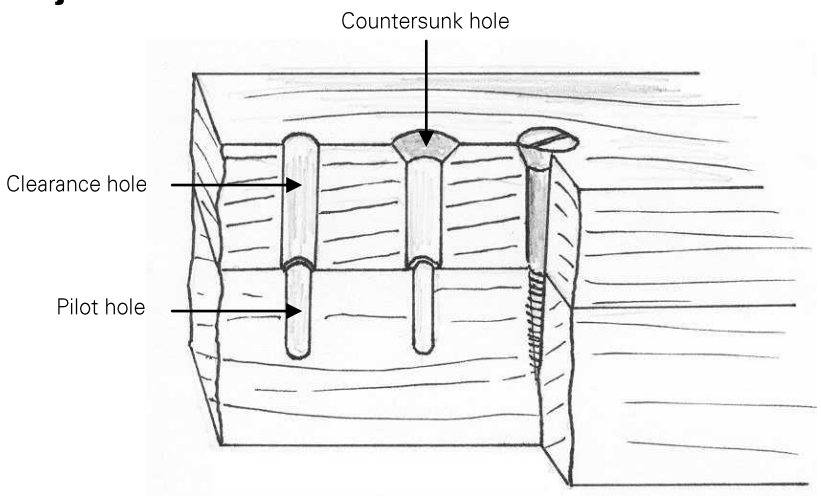
Screwdriver tip is too ***small*** for the screw head. There is not enough torque to turn the screw effectively and the head of the screw is damaged.

A screwdriver with a damaged, worn out or rounded point will tear the screw head.



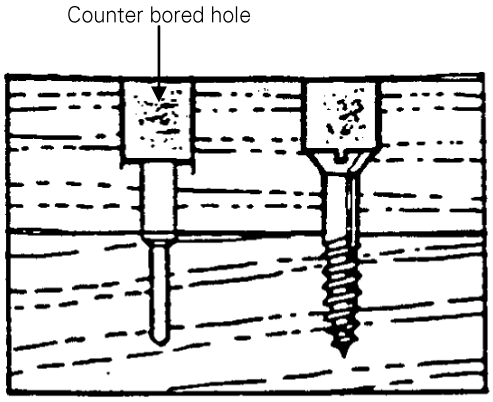
Use: *Grip the screwdriver firmly making sure that it remains perpendicular to the work. Keep a firm pressure down on the screw to maintain control and turn the screw in a clockwise direction to insert it, anticlockwise to remove it.*

Preparing the job



- The pilot hole for the thread should be slightly smaller than the diameter of the core and is only needed if the timber is hard or likely to split. In soft timbers, the pilot hole for the thread can be omitted. A small bradawl hole will usually do the job.
- A drill shank, or clearance hole, allows the screw to move freely in the top piece of timber.
- A countersunk hole provides space for a countersunk or raised head screw.

Shorter screws can be used in thicker pieces of timber. Counter bore the screw by drilling a large hole first, followed by the pilot and clearance holes.



Activity 4

1. Identify and describe the potential consequences of using a hammer with a dirty or damaged face.

2. Describe the potential consequences of using a hammer with the following defects:

Cracked or split handle:

Loose head:

3. What personal protective equipment (PPE) should always be worn when using a hammer?

4. What type of hammer is most commonly used on construction sites?

5. What type of hammer is most commonly used for bench or finishing work?

6. When nailing, it is advisable to hold the nail just under the head, so that if the hammer slips it is more likely to be deflected away from the fingers.

Describe the consequences if the hammer slips when the nail is held at its base.

7. When using a hammer, how should it be held in order to achieve its maximum efficiency?

8. Identify 2 items that, when struck, will likely damage the face of a hammer.

9. How should a hammer face be cleaned?

10. What should be done to minimise damage if the work must be struck with a hammer or mallet?

11. What are the potential hazards associated with having burrs on nail punches?

12. Describe how the burrs should be removed.

13. Identify and describe the main advantage a rubber headed mallet has over a conventional wooden mallet in carcass construction.

14. What would be the disadvantage of using a softheaded mallet to drive a chisel?

15. Describe what would happen if a mallet was used to strike steel or a hard surface?

16. In the space provided below, sketch and name 4 different types of screw heads.

17. Sketch and describe the consequences of using a screwdriver that is too small for the screw head that is being driven.

Gripping Tools

Adjustable spanner

Made from strong tempered steel and has a machined screw for adjustment. Available in varying sizes from 100 to 300mm.

Use

For fastening or holding various sizes of nuts and bolts.

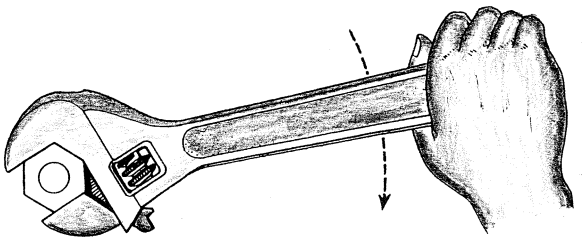
Use the correct size spanner for the job so the right amount of torque can be applied.

Care and maintenance

Keep spanner clean and free of rust.

Lightly oil the screw mechanism.

Always locate and use the adjustable spanner in the manner shown so the solid section takes the majority of the applied force.



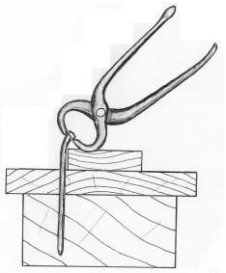
Note: *Adjustable spanners may slip when under pressure and cause damage to the work or injury to the operator. They should never be used on quality or finishing work. Fixed spanners or sockets are the correct tools for this type of work.*

Pincers

Pincers are used to remove small nails or tacks.

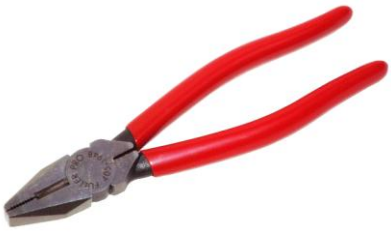
Place a piece of scrap timber between the pincers and the work:

- to protect the face of the work from damage; and
- to gain more leverage for the pincers.



Pliers

Pliers are manufactured from tempered alloy steel. They have a serrated jaw to provide grip and leverage, and finely honed cutting edges to cut most types of wire. They are usually fitted with bonded vinyl grip on handles.



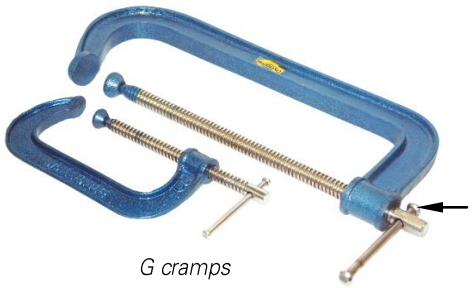
Use	Care and maintenance
For cutting wire, bending metal and gripping work.	Keep pliers clean and free from rust. Lightly oil scissor joint.

Cramps

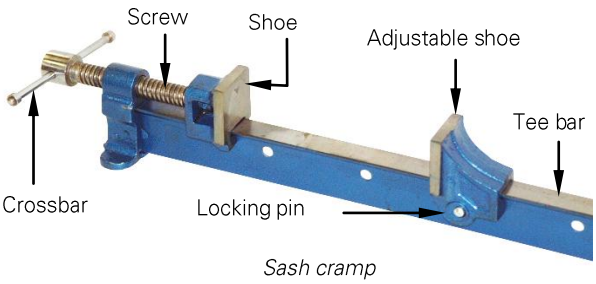
Cramps are used for holding pieces of timber together while they are being worked, glued or fixed.

Some of the most common cramps are:

- **Sash cramps**, which are used for cramping together carcasses, frames, doors and edge-to-edge jointing, e.g. tabletops;
- **F and G cramps**, which are used to hold work firmly on the bench, and for clamping small components together; and
- **Mitre cramps**, which are used for holding mitred pieces together while the glue sets, e.g. picture frames.



G cramps



Sash cramp

Use

- To prevent damage to the work, place scrap timber between the jaws and the work, and place paper between the clamps and the work to prevent any glue from coming in contact with the steel.
- Test fit all joints, and set up cramps to correct size before applying the glue for final cramping.
- Ensure that the clamps are set at 90 degrees to the face being cramped.
- Take care not to overtighten the cramps, as the cramp can be twisted out of alignment.

Summary

Tool care and maintenance

- Good workmanship is impossible with tools that are blunt, dirty or rusty, or have broken or splintered handles. Hand tools should always be kept sharp and in good condition.
- Keep tools dry and rub them with light machine oil to prevent rust.
- Clean any soil, sand or concrete from timber before using sharp edged tools on it.
- Make a habit of going through the tool kit or toolbox at the end of the day to check that all tools have been collected, cleaned and put away.
- If you find any damaged or faulty tools, tell your teacher/tutor.

Carrying and storing sharp tools

- Using sharp tools carelessly can result in serious accidents.
- Don't carry too many tools at once.
- Don't carry sharp-edged or pointed tools in an apron pocket or nail pouch.
- If you're carrying a sharp tool, point it towards the floor and hold it firmly.
- When passing sharp tools to someone else, pass them handle first.
- Cutting edges lose their sharpness when they are in contact with metal, so take care when handling, packing or transporting tools.
- Store tools in a kit bag or toolbox.
- Withdraw plane irons from the cutting position when packing them away.
- Keep the cutting edges of chisels and saws away from other metal tools.
- Keep drill bits in a container – don't leave them loose.

Safe use of hand tools

Hand tools cause accidents when:

- the tool is not being used properly;
- the wrong tool is used for the job; and
- faulty tools are used.

To avoid having an accident when using hand tools, always:

- use the right tool for the job;
- use the correct personal protective equipment (PPE);
- use the correct work method – follow the manufacturer's and the teacher's/tutor's instructions;
- keep cutting tools sharp – it is much easier to receive an injury from a blunt tool than a sharp one; and
- repair or replace defective or faulty tools or tell the teacher/tutor about them.

Activity 5

1. Describe the effects that may occur to the work if glue comes in contact with steel cramps.

2. Describe the effect on the job of using cramps that are set up out of alignment.

3. Describe 2 methods for testing that a frame in the cramps is square. Use sketches to assist with the explanation.

Method 1

Method 2

4. Why should adjustable spanners never be used for precision work?