Unit CSA–L10cc10
MAINTAIN AND USE CARPENTRY AND JOINERY HAND TOOLS

LEARNING OUTCOMES
L01/2: Know how to and be able to maintain and store carpentry and joinery hand tools
L03: Know how to use carpentry and joinery hand saws
L04: Know how to use carpentry and joinery hand-held planes
L05: Know how to use carpentry and joinery hand-held drills
L06: Know how to use wood chisels
L07: Be able to use carpentry and joinery hand tools
INTRODUCTION

The aims of this chapter are to:

- help you to maintain and store carpentry and joinery hand tools
- help you to use a range of carpentry and joinery hand tools.

MAINTAINING AND STORING CARPENTRY AND JOINERY HAND TOOLS

As you become more expert as a carpenter or joiner you will need to work with a wide variety of hand tools. Good quality tools should be looked after, so regular maintenance and sharpening is necessary. You will need to become skilled in using tools that are capable of cutting, planing, shaping, creating holes, marking off and clamping or holding timber in place while you are working on it.

Hazards, health and safety and risk assessment

Probably the greatest hazards from hand tools are as a result of them being misused or poorly maintained. Whenever a tool cannot be properly repaired it should be replaced.

There are many different ways of controlling hazards:

- Pick the tool that has the right weight, size and type of handle and grip that you need for the job.
- Always use the right tool – it should be light and comfortable to use.
- When possible, use a vice or a clamp to hold the timber in place while you work on it.
- Always try to stand or be in a comfortable position while you are working. This means being balanced with your weight evenly distributed and not over-stretching.

See the beginning of Chapter 4 for more information on using tools safely.

Sharpening hand tools

Any hand tool with a blade will need to be sharpened from time to time. This is all part of the care and maintenance of the tool.
Sharpening saws
Although for some operations hard point saws are used that cannot be sharpened, more traditional saws need to be topped, shaped, set and sharpened. Table 5.1 outlines the process of sharpening and maintaining a saw.

<table>
<thead>
<tr>
<th>Maintenance activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topping</td>
<td>This is the first stage. The teeth are likely to be at different heights as a result of wear. A file is wedged into a block of timber. The file is then drawn carefully along the length of the saw. This will make the topped edge parallel with the bottom of the saw teeth. The points of the teeth will be re-established at the shaping stage.</td>
</tr>
<tr>
<td>Shaping</td>
<td>First clamp the blade in a saw stock and file from the handle end to get the teeth back to their original size and shape. A file is used horizontally across at right angles to the blade. There are two types of saw teeth: rip and cross cut. Rip saw teeth should be filed at 90° so they are shaped like an inverted right-angled triangle that slopes on the back edge and is flat on its cutting edge. Cross-cut teeth are shaped like an equilateral triangle sloping front and back. When shaping the teeth, start at the handle end and shape every other tooth at 60°. Then turn the saw around and shape every other tooth that was omitted on the first pass. This should leave all the teeth the same size and shape.</td>
</tr>
<tr>
<td>Setting</td>
<td>This describes the width of the saw blade from the outside of the teeth on one side to the outside of the teeth on the opposite side. Saw set pliers are placed over the blade and then squeezed to set each alternate tooth. The saw is then turned around to deal with the remaining teeth. The saw set can be set to the required number of teeth per inch depending on how fine the saw is. The greater the number of teeth per inch the finer the saw and the cut it produces. Rip saws are usually set at 5 to 7 per inch and cross cuts at anything from 7 to 10 per inch. Panel saws tenon saws, dovetail saws and gents saws are set much finer.</td>
</tr>
<tr>
<td>Sharpening</td>
<td>A triangular saw file is used to create a sharp edge on the front of each tooth. This is an important process that will take some time to perfect. Once you have worked along the length of the saw you need to turn it round and repeat the process. Work from the handle end. The saw file will be held at 90° to the saw side for rip saw teeth and at an angle for cross-cut teeth. Look at the angle of the original sharpening of the teeth and follow the same line. Maintain the same angle on each and count the number of strokes made with the file for each tooth. Maintain the same pressure and work on every other tooth. Then turn the saw around and repeat on the other side, picking up the teeth missed on the first pass.</td>
</tr>
<tr>
<td>Dressing</td>
<td>This removes any final imperfections in the saw. A medium grade oil stone or slip stone is used to take off the wire edge formed by filing the teeth.</td>
</tr>
</tbody>
</table>

**Table 5.1**

### Shape and size of saw teeth

<table>
<thead>
<tr>
<th>Type of saw</th>
<th>Shape and number and types of teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rip saw</td>
<td>The saw can be up to 750 mm long. It has 5 to 7 teeth per 25 mm. Usually this is described as being 5 to 7 tpi, or teeth per inch.</td>
</tr>
<tr>
<td>Cross-cut saw</td>
<td>These can be up to 650 mm long and have a tpi of 6 to 8.</td>
</tr>
<tr>
<td>Panel saw</td>
<td>These are around 550 mm in length and have a tpi of 10 to 12.</td>
</tr>
<tr>
<td>Tenon saw</td>
<td>The blades are between 250 and 350 mm long, with a tpi of 10 to 20. Many carpenters have two. They use a bevelled teeth version for cross-cutting, and one with the teeth recut square across the face for ripping with the grain.</td>
</tr>
<tr>
<td>Dovetail saw</td>
<td>These are between 200 and 250 mm long with a tpi of 16 to 20.</td>
</tr>
<tr>
<td>Gentlemen's saw</td>
<td>The blades are between 100 and 250 mm with a tpi of 32.</td>
</tr>
</tbody>
</table>

**Table 5.2**
The first diagram shows you the equipment you need to sharpen saws. The second diagram shows you how the saw maintenance is carried out.

**Figure 5.1** Saw sharpening equipment

**Figure 5.2** Saw maintenance

- **Saw stock for clamping hand saws**
- **Saw set pliers**
- **Flat file wedged in jig for topping**
- **Triangular saw file**
- **Worn saw blade 'cows and calves'**
- **Topping**
- **File to straight line**
- **File each alternate tooth to shape and remove shiner, reverse saw and repeat to shape other teeth**
- **Gullet**
- **Sharpening**
- **Light top to recreate a small shiner**
- **Side dressing**
- **File bevel on each alternative tooth, reverse saw and repeat to sharpen other teeth**
- **File cross-cut saws at 60°**
- **File rip saws at 90° until shiner disappears**
- **'Saw chops' secured in vice for clamping back saws**
- **Level up 'cows and calves', giving a flat spot 'shiner' on each tooth tip**
- **File to straight line**
- **Worn saw blade 'cows and calves'**
- **Topping**
- **File each alternate tooth to shape and remove shiner, reverse saw and repeat to shape other teeth**
- **Gullet**
- **Sharpening**
- **Light top to recreate a small shiner**
- **Side dressing**
- **File bevel on each alternative tooth, reverse saw and repeat to sharpen other teeth**
- **File cross-cut saws at 60°**
- **File rip saws at 90° until shiner disappears**
- **'Saw chops' secured in vice for clamping back saws**
- **Level up 'cows and calves', giving a flat spot 'shiner' on each tooth tip**
**Sharpening planes and chisels**

The cutting edges of planes and chisels are ground to a bevel with an angle of 25°, as can be seen in Fig 5.3.

The second bevel is the honing bevel and is formed at 30° to make it more durable. Some carpenters/joiners prefer to keep the grinding and honing bevels the same – this is perfectly acceptable and gives a keener or sharper edge. The only difference is that the second method will require more frequent honing of the cutting edge. The thin edge may chip more easily.

Most of the cutting edges of planes and chisels are square, although there are some exceptions. The corners of all plane blades are removed to stop them from digging in at the corners. Plane blades can be sharpened with a slight radius and some tradespeople prefer this technique, as it encourages a smoother cutting action.

When you are sharpening planes and chisels the first stage is to grind the blade using either a grindstone or the coarse side of a sharpening stone if no access to a grindstone is available. Once this has been done the blade is then honed using a fine sharpening stone.

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**PRACTICAL TIP**

Over time, hand saws become worn until they require a re-cut. They should be taken to a maintenance specialist, or saw doctor. These professionals know exactly how to deal with any problem with the saw and to extend its working life. See www.sda.uk.co.uk for details of the Saw Doctor Association.

**KEY TERMS**

**Bevel**

– this is a slope or edge that is away from either the horizontal or vertical.
Grind angle with tool rest set at 25° Use try square to test for squareness

Use firm to-and-fro strokes or a figure-of-eight pattern to form honing bevel

Wide blades may require angling across the stone

Honing forms a burr on the underside

Use your thumb to feel for the burr

Use light to-and-fro strokes to remove burr, keep the back of the iron flat on the stone

Draw cutting edge across corner of a piece of waste to remove wire edge left after honing

Scribing gouge

Bevel honed on slipstone

Use rocking action up and down stone

Burr removed on flatstone

Firmer gouge

Bevel honed on flatstone

Use rocking action up and down stone

Burr removed on slipstone

Note that these pictures show sharpening tools being used without gloves, for clarity. You should always wear appropriate PPE when sharpening tools.
Sharpening stones
There are various different types of sharpening stones. These are described in Table 5.3

<table>
<thead>
<tr>
<th>Sharpening stone</th>
<th>Description and use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil stone</td>
<td>These are available in fine and medium grades, although you can also buy fine and medium oil stones that are in fact two stones glued together. The medium grade is used to deal with the grinding bevel and the fine grade for the honing. They are called oil stones as oil is used to lubricate them when they are being used.</td>
</tr>
<tr>
<td>Water stone</td>
<td>These are finer than oil stones but available in various grades of coarseness. They need to be lubricated with water. They are primarily used for honing.</td>
</tr>
<tr>
<td>Diamond stone</td>
<td>Tiny particles of diamonds are bonded to a plastic base. They are available in a number of different grades. These are also used to hone an edge on the tool, providing a sharp blade.</td>
</tr>
</tbody>
</table>

Table 5.3

Legislation and grinding wheels
Grinding wheels present particular hazards because of the speed of their rotation and the fact that they are very abrasive. You must be sure you are fully trained and competent before using any abrasive wheel. Possible accidents include friction burns, crushed fingers and loss of eyesight.

Under the Health and Safety at Work Act (1974) employers have to make sure that risk assessments are carried out. The Abrasive Wheels Regulations were revoked and now come under the Provision and Use of Work Equipment Regulations (1998), where there are additional requirements. This means that the rules cover anyone using either fixed or portable grinding wheels and anyone who might come into contact with flying particles from the machine.

Operators of abrasive wheels should receive appropriate training and wear the right PPE. This means wearing some kind of eye or face protection, which could mean goggles or a face shield. You should also wear gloves and, to protect you against the dust, you should have respiratory protection.

However, PPE should not be the first line of defence in protecting yourself. Grinding wheels must have guards, shields and, to protect the workplace from dust and other contaminants, a local exhaust ventilation system (LEV).

PPE for maintaining hand tools
As an absolute minimum you should always wear eye protection when maintaining your hand tools.

When you are sharpening hand tools on a grindstone you will be creating tiny particles of metal. These are potentially very dangerous, particularly to the eyes.
You should always wear some kind of hand protection too. The thickness of the gloves will depend on the job, as you may need to be able to hold things as well. These will protect you against cuts, abrasions and any impact.

**Different types of carpentry and joinery hand tools**

For the purposes of this section we have listed and briefly described the different types of carpentry and joinery hand tools. Each of the hand tools is covered in more detail in the following sections of the chapter. Table 5.4 describes different types of saw.

**Saws**

<table>
<thead>
<tr>
<th>Type of saw</th>
<th>Description and use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rip saw</td>
<td>These are large saws, primarily used for cutting along the grain.</td>
</tr>
<tr>
<td>Cross-cut saw</td>
<td>These are used for cross-cutting purposes.</td>
</tr>
<tr>
<td>Panel saw</td>
<td>These are the shortest and finest of the hand saws and used to cut sheets.</td>
</tr>
<tr>
<td>Tenon saw</td>
<td>These are useful for cutting of cheeks and shoulders of tenons. It is also used for fine carpentry and joinery operations.</td>
</tr>
<tr>
<td>Dovetail saw</td>
<td>These are used for cutting dovetails, mouldings, detailed and fine work.</td>
</tr>
<tr>
<td>Gents saw</td>
<td>This is a fine back saw. With virtually no set it produces a very fine cut due to the thinness of its kerf and the number of teeth.</td>
</tr>
<tr>
<td>Bow saw</td>
<td>Originally this was a general site carpentry saw but more modern versions can be used for cross-cutting, ripping and cutting curves. They are used for general carcassing work and are often used in green oak timber framing.</td>
</tr>
<tr>
<td>Coping saw</td>
<td>Coping or fret saws are used to cut circles, curves and shapes. They were originally used in conjunction with a fretting table, but their primary use these days is to scribe mouldings such as skirtings on internal angles.</td>
</tr>
<tr>
<td>Japanese saw</td>
<td>These cut on the pull rather than the stroke and have long teeth and a thin blade. They are used for carcassing work as well as fine work. They can be purchased in various sizes and with varying degrees in terms of the accuracy of cut.</td>
</tr>
<tr>
<td>Keyhole saw</td>
<td>These are also called pad saws and are used for cutting out small shapes or holes.</td>
</tr>
<tr>
<td>Compass saw</td>
<td>These are used to cut out larger shapes or holes.</td>
</tr>
<tr>
<td>Mitre saw</td>
<td>These are used in a metal jig to cut specific angles. They are used for fine mouldings and for other small components.</td>
</tr>
<tr>
<td>Hacksaw</td>
<td>This is a range of different saws that are primarily used for cutting metal.</td>
</tr>
<tr>
<td>Floorboard saw</td>
<td>These are short saws with teeth running both in the normal way but also on a curved nose. This allows a cut to be started without first drilling through the board.</td>
</tr>
</tbody>
</table>

Table 5.4
Rip saw

Cross-cut saw

Panel saw

Rip teeth

Cross-cut teeth

Teeth per 25 mm or per inch (TPI)

Figure 5.5 Hand saws

Tenon saw
Dovetail saw
Gents’ saw

Figure 5.6 Back saws

Wooden frame bow saw
Coping saw
Metal frame bushman saw

Figure 5.7 Frame saws

Pad saw
Compass saw

Figure 5.8 Narrow blade saws
Rip teeth

Cross-cut teeth

'Ryoba'
Japanese hand saw

'Dozuki'
Japanese back saw

Long Japanese teeth

Mitre frame saw

Standard hacksaw

Teeth continue around curved end

Floorboard saw

Junior hacksaw

Figure 5.9 Other types of saw
Chisels
At the very least, a competent tradesperson should keep in their toolbox bevel-edged chisels ranging from 6 mm to 32 mm, three or four mortise chisels, 10 mm, 12 mm, 15 mm and 25 mm, and in-cannel and out-cannel gouges of a common size such as 12 mm.

<table>
<thead>
<tr>
<th>Type of chisel</th>
<th>Description and use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firmer chisel</td>
<td>This is a general-purpose chisel with a strong blade. It has a rectangular section blade that can be driven into wood using either a mallet or the flat face of a hammer if the chisel is fitted with a shatterproof handle.</td>
</tr>
<tr>
<td>Registered chisel</td>
<td>These chisels have a steel band or ferrule on the end, which protects the handle when it is being hammered.</td>
</tr>
<tr>
<td>Mortise chisel</td>
<td>These are strong chisels with a thick, rectangular blade. It is used for chopping mortises.</td>
</tr>
<tr>
<td>Bevel-edged chisel</td>
<td>These are similar to firmer chisels, with a bevel on the edges of the blade. They are used for chiselling corners and are often used for dovetail joints and much finer work.</td>
</tr>
<tr>
<td>Paring chisel</td>
<td>These are longer and lighter versions of bevelled edged chisels. They are hand chisels so they are not hammered. Their extra length makes them easier to control when paring.</td>
</tr>
<tr>
<td>Skew-end paring chisel</td>
<td>These are used when you need to pare difficult corners.</td>
</tr>
<tr>
<td>Gouge</td>
<td>These are curved chisels. They can be used for carving, shaping and scribing. Scribing gouges are sharpened on the inside of their curve. The alternative is to grind and hone a firmer gouge on the outside of the curve for carving and for hollowing out.</td>
</tr>
</tbody>
</table>

Table 5.5

Figure 5.10 Chisels and gouges
Figure 5.11 A range of chisel handles
Planes

<table>
<thead>
<tr>
<th>Type of plane</th>
<th>Description and use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothing plane</td>
<td>A smoothing plane is a general purpose plane also used for cleaning up and fine finishing of timber joints.</td>
</tr>
<tr>
<td>Jack plane</td>
<td>A jack plane is used when greater accuracy is needed over longer lengths. The longer the plane the flatter the surface over its length. Since a jack is longer than a smoothing plane it is more accurate on longer lengths.</td>
</tr>
<tr>
<td>Try plane</td>
<td>Also known as a jointer plane. This is used for the truing of long lengths of timber. It is similar but easier to handle than longer planes because it is lighter.</td>
</tr>
<tr>
<td>Corrugated sole plane</td>
<td>These have a corrugated bottom, which is ideal if you are planing timber with a high resin content.</td>
</tr>
<tr>
<td>Bench rebate plane</td>
<td>Also called a carriage or badger plane, this has a blade that extends the full width of the sole. It is used for creating or cleaning large rebates.</td>
</tr>
<tr>
<td>Block plane</td>
<td>These are used to work across the end grain and for cleaning up laminate edges. They are sometimes used to clean up but usually only on small frames or fine work such as furniture.</td>
</tr>
<tr>
<td>Shoulder plane</td>
<td>Their primary function is given in the name – they are for fitting the shoulders on tenons, especially in fine cabinet work where a shoulder cut with a tenon saw does not give a sufficiently fine finish.</td>
</tr>
<tr>
<td>Bullnose plane</td>
<td>These are particularly useful for working into the corners where rebates meet and for stopped rebates and chamfers because their cutting iron is towards the front.</td>
</tr>
<tr>
<td>Hand router plane</td>
<td>These are used to level out the bottom of grooves and housings where greater accuracy is required than can be obtained with a paring chisel.</td>
</tr>
<tr>
<td>Compass plane</td>
<td>These are used to clean up internal and external curves and smooth them out. The sole is a flexible steel strip that can be adjusted to suit the curve.</td>
</tr>
<tr>
<td>Spokeshaves</td>
<td>These are used to clean up internal and external curved edges. They work best if used with the grain.</td>
</tr>
<tr>
<td>Rebate plane</td>
<td>These are used to cut rebates.</td>
</tr>
<tr>
<td>Plough plane</td>
<td>These are used to create trenches and grooves of various thicknesses and come with various interchangeable blades.</td>
</tr>
<tr>
<td>Combination or multi-plane</td>
<td>These are designed to be able to do the job of a range of different planes and have different cutters. This allows them to be used for ploughing, rebating and moulding.</td>
</tr>
</tbody>
</table>

Table 5.6
Hand drills and braces

In the past these were the main tools used by carpenters to drill or bore holes into timber. Even though they have been largely replaced by battery or mains powered drills they are still very useful.

Hand drills are available in two different forms:

- **Wheel brace drills** are used for drilling and countersinking in the same way an electric or battery powered drill would be used.
Ratchet brace drills are sometimes called carpenters braces and may have a ratchet facility. They can be used for boring out the bulk of the material when forming deep mortises for locks. By engaging the ratchet, they can be used in restrictive spaces where a full sweep of the brace is not possible. They are also used to bore holes of between 3mm and 38mm with standard augers and with the use of an expansive bit. This can be extended to 75mm, which is useful for forming letter plate openings.

Table 5.7 outlines the types and use of different ratchet brace bits.

<table>
<thead>
<tr>
<th>Ratchet drill bit</th>
<th>Description and use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jennings pattern bit</td>
<td>Also known as double helix bits, this feature gives a smoother finish and clears away material from the cut quicker.</td>
</tr>
<tr>
<td>Centre bit</td>
<td>These tend only to be used to bore very shallow holes, for example, when fitting night latches.</td>
</tr>
<tr>
<td>Irwin bit</td>
<td>Also known as a single helix bit, this is an alternative to the Jennings pattern bit and does the same job.</td>
</tr>
<tr>
<td>Forstner bit</td>
<td>These are used to create flat-bottomed holes.</td>
</tr>
<tr>
<td>Expansive bit</td>
<td>These are used to make large holes.</td>
</tr>
<tr>
<td>Countersink bit</td>
<td>These are used to create holes that will have countersunk screws in them.</td>
</tr>
<tr>
<td>Screwdriver bit</td>
<td>Because of the extra leverage and quicker action of the ratchet brace these are a good alternative to standard screwdrivers. They are also commonly used to extract embedded screws.</td>
</tr>
</tbody>
</table>

Table 5.7

Maintaining and storing hand tools

These practical tasks look at how to store and maintain hand tools. They cover all of the different resources that you will need and how to regrind angles. They also show you how to use sharpening stones, along with the PPE that you should be using.
1. **GRIND BLADES**

**OBJECTIVE**

To practise grinding blades of different hand tools.

The cutting edge of plane blades, chisels and gouges can be ground to the correct angle by one of two methods: dry grinding and wet grinding. Dry grinding is a much quicker way of grinding, however, the potential for burning or blueing the blade is increased as it is much harder to keep the blade cool. When a blade blues it has effectively lost its temper at that point, resulting in a blade that will not hold an edge. Wet grinding is a much slower process but eliminates the chance of blueing the cutting edge.

There are several manufacturers of wet grinding systems using water as a coolant.

Before any work commences the machine should be correctly installed, positioned to the correct height and secured. A light mounted over the grinder is essential.

**PPE**

Ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

No gloves are worn in the pictures that follow, in order to clearly show sharpening processes. However, you should wear gloves, and other PPE as appropriate, when working with sharpening tools.

**WET GRINDING**

**STEP 1** Fill the cooling reservoir with water; this is normally a trough that the grinding wheel has to pass through. This keeps the wheel cool, stopping the build-up of heat in both the wheel and the blade. Attach the reservoir in position.

**STEP 2** Fix the blade into the traveller. All systems incorporate a similar type of tool holder so read the manufacturer's instructions for the make and model being used.

**STEP 3** Decide if you are going to grind with the blade facing towards or away from you – both methods are acceptable. Slide the tool holder or traveller onto the bar suspended over the wheel and set the grinding angle at 25°. Most systems incorporate a method of determining and setting the correct angle.
**Step 4** Turn on the grinder and move the blade across the edge of the wheel. Keep a constant pressure on the blade to ensure that half the blade width is in contact with the grindstone at all times.

**Step 5** Check that the angle has been ground evenly across the blade and that the edge of the blade is square. Adjust as necessary by angling the blade in the holder.

**Step 6** Some grinders are fitted with a leather honing wheel. It is essential that the blade is brought to this wheel with the rotation moving away from the blade to avoid a serious accident. The same holder is used as before. Apply honing paste to the wheel and hone to a sharp edge.

**Step 7** Remove the holder from the grinder and remove the blade from the holder.

**Step 8** Turn off the machine and remove the reservoir.

**Step 9** Restart the machine and allow it to run for a few minutes. This prevents the water gathering in the bottom of the wheel and making it egg-shaped.

**Step 10** The blade will have a burr on the back edge that can be felt by rubbing your thumb over the back of the blade. Apply oil to a sharpening stone and place the back edge of the plane flat on the stone, then draw the blade backwards along the stone to flatten the burr.

**Step 11** Finish by stropping the blade on a piece of leather.
SECTION 2

Honing Plane Blades and Chisels on an Oilstone

OBJECTIVE

To practise the traditional method of sharpening or honing a blade.

There are many types of sharpening stones on the market including oilstones, ceramic stones, water stones and diamond stones. The basic method of obtaining a sharp edge remains the same, the main difference being the method of lubricating the stone. Oilstone can be natural or manmade; natural stones are more expensive.

Make sure there is sufficient light and that the stone is at a good working height and secure.

2. Hone Plane Blades and Chisels on an Oilstone

PRACTICAL TASK

Step 1

Turn the oilstone to the coarsest side. Most stones are combination stones.

Step 2

Apply a pool of oil to the stone and place the blade onto the stone with the back edge down. Lap the blade by moving the blade backwards, forwards and across the stone simultaneously.

Step 3

Place the blade into the pool of oil and lift the back edge until the oil is squeezed out on the front edge. At this point the grinding angle is flat to the stone.

Step 4

Move the blade backwards and forwards down the length of the stone, keeping an even pressure. Keep your wrists parallel to the stone and avoid rocking the blade. Use the full width of the stone. Some carpenter/joiners use a figure of eight motion; however, this is not essential as long as all the stone is used.

Step 5

Check that the blade is ground flat across the whole width of the blade by checking it for square and parallel.

Step 6

Remove oil from the stone with a rag, and apply fresh oil.

HONING A BLADE ON AN OILSTONE

Step 1

Apply a pool of oil to the stone and place the blade onto the stone with the back edge down. Lap the blade by moving the blade backwards, forwards and across the stone simultaneously.

Step 2

Wipe the stone and reapply a pool of oil as before.

Step 3

Place the blade into the pool of oil and lift the back edge of the blade until the oil squeezes from the front edge of the blade. The blade is now sitting on its 25° grinding angle. Lift the back end of the blade a little so that a 30° angle is achieved and repeat Step 4 from the previous practical task.

PPE

In this and the tasks that follow, ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

No gloves are worn in the pictures that follow, in order to clearly show sharpening processes.

However, you should wear gloves, and other PPE as appropriate, when working with sharpening tools.
This process can be achieved through wet or dry grinding; however, wet grinding is far easier and safer.

**Objective**

To practise sharpening drill bits.

There is a tendency to throw away drill bits that have become blunt, when in fact they should last many years with regular maintenance through sharpening. Wet grinding makes this process very simple; most systems incorporate jigs for drill sharpening to the finest tolerances. With practice a high degree of accuracy can be achieved by sharpening freehand against a tool rest.

**PPE**

In this and the tasks that follow, ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

**3. SHARPEN HSS DRILL BITS**

**STEP 1** Check the drill manufacturer’s literature to find the correct grinding angle.

**STEP 2** Either set the drill sharpening jig to the correct angle using the manufacturer’s instructions or use the tool rest to bring the drill bits to the edge of the stone at the correct angle.

**STEP 3** When sharpening freehand, a jig to hold the drill bits should be made to keep your fingers well away from the grinding wheel.

**STEP 4** Touch the drill bit against the stone at the required angle. Keep the drill bit at the same angle and twist it through 180° to grind the opposite side.

This process can be achieved through wet or dry grinding; however, wet grinding is far easier and safer.

**STEP 5** Check for a burr on the back edge of the blade, using the side of your thumb.

**STEP 6** Place the blade flat with its back edge down on the stone and pull the blade towards you.

**STEP 7** The blade should now feel flush on the back edge and will now have a wire edge along the length of the cutting edge.

**STEP 8** Strop the blade on a leather strap to remove the wire edge, leaving the edge keen.

**Figure 5.26 Checking the burr**

**Figure 5.27 Stropping the blade**

**Figure 5.28 Sharpening the drill bit**
4. SHARPEN AUGERS

**OBJECTIVE**
To sharpen augers with a file.

**PPE**
In this and the tasks that follow, ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.

**STEP 1** Place the auger in a vice with the spurs face up.

**STEP 2** The spur should always be sharpened first. Augers are manufactured to different diameters and these are measured across the outsides of the spurs. Do not file anything from the outsides of the spurs as this will render the auger useless.

Using a flat-faced file, sharpen the inside face of each spur in turn. The file should be large enough to cover the whole surface of the spur.

**STEP 3** Use a triangular or flat file to sharpen the cutting edge or edges (some augers have a single cutting edge but better quality augers have two). Again file in the direction of the cut of the file, keeping the file flat on the cutting angle so that it does not become rounded. Count the number of strokes used and repeat for both sides.

**PRACTICAL TIP**
- Only file in the direction of the cut of the file.
- Do not use a forwards and backwards motion.
- Count the numbers of strokes used on the first spur and use the same amount on the opposite spur.
- Do not allow the file to touch the cutting edge of the auger.

**PRACTICAL TASK**

**Figure 5.29** Sharpen the spurs first

**Figure 5.30** Sharpening the cutting edges

**PPE**
In this and the tasks that follow, ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1.
USING CARPENTRY AND JOINERY HAND SAW

Over the years many different types of saw have been created to do specific jobs. They fall into four main categories:

- **Hand saws** are used for the first cutting to reduce the timber to the size required. Hand saws are split into three sub categories: the rip saw for cutting along the grain, the cross cut for cutting across the grain, and the panel saw, which tends to be shorter and finer toothed for cutting sheet materials or where a finer cut is required in solid timber work such as second fix.

- **Back saws** are sub-divided into tenon saws for forming tenons, general bench work and second fix carpentry. Dovetail saws are for fine joinery work. A gentlemen’s saw produces a really fine cut, and is used for dovetails and delicate mouldings and beading.

- **Frame saws** are saws that generally have fairly fine blades. The blade is held in tension by a frame. They are capable of many different tasks, but uniquely they can cut curves. Frame saws include bow saws, which are used in general carpentry, particularly timber framing; coping saws, which are used extensively in second fix carpentry particularly on scribing skirtings; and fret saws, which are used to produce fretwork in conjunction with a fretting table.

- **Narrow bladed saws** are for fine work, such as making keyholes, so they are long, fine and narrow. Examples are pad saws and keyhole saws, which are used for forming keyholes and cutting small circles and for cutting openings for services such as plug sockets in plasterboards.

As we will see in this section, the saw blade needs to be designed in such a way as to prevent it from binding in the timber. Each alternate tooth is bent outwards to make the saw cut (the set). The set is wider than the rest of the saw blade. The material removed during the saw cut is called the kerf.

As you can see in Fig 5.31, the figure on the top shows that the rip saw has teeth that look like the shape of a chisel. The kerf is the saw cut and the set is the width of the teeth.

The illustration below shows a different type of saw, with cross-cutting teeth. In effect each of the teeth acts like a knife. They are designed to cut through the fibres of the timber. Two cuts are made at the same time on either side of the saw blade.

**Purposes of different types of hand saw**

The practical tasks at the end of this chapter will take you through different ways of cutting and shaping timber using hand saws. But it is important to understand that the way you use the saw will depend on three things:
where you are doing the work – whether this is in the workshop (bench) or on site

- the direction of the cut you need to make

- the material that you are cutting.

In most cases you should follow a set procedure for using a hand saw:

1. Hold the handle with your index finger along the side. This will give you good control.
2. Put your thumbnail of the other hand on the line that you have marked to cut.
3. Begin cutting by drawing the saw backwards using short strokes.
4. Relax your grip and begin to saw using full blade strokes.
5. Apply pressure when you make a forward stroke and apply consistent pressure when pulling back.

**Ripping and cross-cutting on stool**

For ripping on stools you should use an angle of around 60°. If you are ripping a large length or a big board you may have to balance it on two stools. If the material closes in on the blade and prevents you from using the saw in a smooth motion then you should insert a wedge. An alternative is to rub some candle wax onto the saw blade to make it run smoother.

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
If you are cross-cutting you should cut at an angle of around 45°. Any overhang should be supported. You should use your knee to secure the board and only use gentle strokes at the end of the cut, otherwise the board could split.

**Ripping with the piece in a vice**

Begin by putting the piece firmly into the vice and cut vertically. You will need to then undo the vice, turn the timber and finish off the cut from the other end.

If you are ripping joints it is advisable to have the timber at an angle. This will allow you to see the ripping line and the line on the end grain. You will rip down to your pencil line and this will leave the pencil line still visible.

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
Cross-cutting on the bench
You can either hold a bench hook in a vice or hook it over the front of
the bench. This serves the double purpose of protecting the bench and
securing your piece of timber.

Using a coping saw
Coping saws are useful to take out waste material in joints. The piece
of timber should be held securely in a vice, with around 50 mm of
the timber above the surface of the bench. You can also use a coping
saw to cut out shapes in timber. You begin by drilling a hole and then
inserting the blade of the saw into the hole before assembling the saw.

Cutting sheet material
Panel saws are useful to cut manufactured boards. If you are cutting
across the grain it is often a good idea to score the faces of the board
with a knife or gauge. You should make the cut on the waste side.
This will prevent the board from splitting and producing a jagged edge.
Boards should always be cut while fully supported, for example using
a pair of saw stools. It is also advisable to put battens underneath the
board for additional support.

No gloves are worn in these pictures, in order to clearly show how
to use saws and hand tools. However, you should wear gloves and
other PPE required by your college or employer.
Using hand tools to improve your skills

Joshua Richardson is a third-year apprentice joiner at Laing O’Rourke.

‘Your hand tools are definitely important. I wasn’t allowed to use power tools at work until I turned 18, because they can be quite dangerous. So you have to get used to cutting everything with the hand saw. It can be a lot of work – imagine cutting down four sheets of ply at once! We still usually use hand tools for most things. One of the joiners has an electric plane, but we’ll use the hand plane instead.

What my team does is maintain health and safety on the site with temporary works, so if there’re holes anywhere or hoardings to go up, that’s what we do.

College is totally different to my day-to-day job. It’s also more about hand tools, but there it’s mostly bench joinery work, learning how to make your joints, making frames, chiselling out, hanging doors, drawing, working off drawings – it’s more clean, precise work. I don’t get the opportunity to do much of that in my line of work, which is more site carpentry.

A lot of people at college will say, why are we doing this, why do we have to learn all this? But you might come across it one day and it gets your basic hand skills better. And, you never know, you might want to work in a different area one day where your bench joinery skills are more important.’

Using carpentry and joinery hand-held planes

Planes are used to cut wood by shaving the surface. They can be used to produce flat and smooth surfaces. Others can be used for more specialist tasks. These can include making grooves, curves, rebates and mouldings.

Types and uses of planes

- **Bench planes** are used to reduce timber to its required size and shape. They can also be used to trim joints or components and to prepare the surface of timber before it is finished off.
- **Specialist planes** only have a cutting iron and no back iron. (The only exception is the compass plane.) The cutting iron is usually positioned bevel side up in order to break up the wood shavings, as can be seen in Fig 5.39.

The hand-held plane is arguably the most difficult tool to master. Bench planes are numbered as in the Stanley Tools system from the smallest (No. 1) to the largest (No. 8). However, they can also be described by name, for example, ‘No. 4 smoothing plane’, ‘No. 5 jack plane’, ‘No. 6 fore plane’, ‘No. 7 try plane’ and ‘No. 8 jointer plane’. The most common planes are Nos 4, 4½, 5 and 6. The No. 4 is regarded as a multi-purpose plane and is used for cleaning up, although many site carpenters prefer the No. 5 or jack plane because of its suitability for fitting doors.

**Planing timber**

The range of different planes can be used for various jobs, including creating face sides and face edges. Each type of plane is suitable for different jobs and there are different ways of going about each task.

**Using bench planes**

As we can see in Fig 5.40, bench planes all have a similar type of construction. However, the thickness of the shavings that are produced and the smoothness of the finish that the plane creates are dependent on four things. These are detailed in Table 5.8.
Factor affecting thickness of shavings and smoothness of finish

<table>
<thead>
<tr>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>How far the cutting iron projects below the sole of the plane</td>
</tr>
<tr>
<td>The plane should produce clean and transparent shavings. There is an adjusting nut and you should set it so that the cutting iron projects by around 0.5 mm.</td>
</tr>
<tr>
<td>How the cutting iron is aligned</td>
</tr>
<tr>
<td>The cutting iron should be parallel with the sole. You can correct it by moving the adjusting lever sideways. The cutting iron should project an equal amount across the whole of the opening in the sole (mouth).</td>
</tr>
<tr>
<td>The distance from the back iron to the cutting iron edge</td>
</tr>
<tr>
<td>Ideally this should be 0.5 mm if you are using the plane to produce a fine and smooth finish. It can be as much as 2 mm if you are intending to take off a considerable amount of material. If there are any gaps between the back iron and the cutting iron the shavings will get jammed and the plane will clog up. You can adjust the distance by slackening the cap iron screw using a screwdriver. You can then set it to the required distance and tighten it back up again.</td>
</tr>
<tr>
<td>The size of the mouth when the cutting iron is in position</td>
</tr>
<tr>
<td>For the majority of timbers this needs to be somewhere between 1.5 mm and 3 mm. For fine work it needs to be narrow and for heavy planing it needs to be wider. The mouth size can be adjusted using the frog. You need to slacken the screws and turn the frog adjusting screw. This will move the frog either forwards or backwards. Once you have done this the securing screws need to be retightened.</td>
</tr>
</tbody>
</table>

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
You should always use jack or try planes to plane long boards. Longer planes are more accurate when planning long boards. A smoothing plane will still achieve a degree of finish and this is largely dependent on the skill of the operative. You should always try to plane with the grain. This will reduce the risk of tearing.

Select a long plane for truing long boards – shorter planes will just follow the bumps and hollows.

Start planing with pressure on toe, transferring to heel to finish the cut.

Plane with, rather than against, the grain to avoid tearing.

If you are working on a large area of timber you should use either a smoothing plane without corners or a jack plane, which is slightly curved. This process is shown in Fig 5.43.

Plane wide tops diagonally.

Use edge of sole to check flatness.

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
Your plane should be set so that you do not remove too much material at one time. If you are uncertain as to whether or not you are taking off an even amount of material you should turn the plane onto its side. You can use the sole of the plane as a straight edge. You will then be able to see if you have any uneven parts of the surface that require more attention.

In order to plane edges you should use the centre of the sole. This is shown in Fig 5.44.

Use your fingers under the sole to act as a guide along the piece of timber. If you are using very narrow pieces of timber you may need to use a shooting board. This can also be seen in Fig 5.45. In this case you use the plane on its side and slide the plane along the piece of timber.

You need to choose the correct plane to clean up ready-assembled framed joinery. As you can see in the following diagram, you need to be very careful as you approach the joints. Take care that when the grain direction changes you do not tear the material. Just as you can check the flatness of a surface using the side of your plane, you can also do this for framed joinery. This will indicate whether or not you need to put any extra effort into smoothing out the area around the joints.

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
One of the main challenges when planing end grain is that you could cause damage in the form of breakout when you reach the end. Ideally you should plane from both corners to the centre. As Fig 5.46 also suggests you could use a shooting board.

Using specialist planes
As we have already seen there is a wide variety of different specialist planes. The ways in which these are used for a variety of different jobs can be seen in Fig 5.47 (a and b).

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
Forming a rebate

Maintain side pressure on fence to avoid stepping

Start cut at forward end working back in stages

Side rebate plane used to ease sides of rebates and grooves

Use of plough plane to cut a groove

Keep sideways pressure on fence

Make second series of cuts to remove this section

Use bench plane to form a wide rebate

Rebates and grooves wider than cutter are formed in several stages

Figure 5.47b Using specialist planes

No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
USING CARPENTRY AND JOINERY
HAND-HELD DRILLS

As we have seen earlier in this chapter, hand-held drills include wheel braces and ratchet braces. For information on cordless (battery-powered) drills and modern power drills you should refer to Chapter 6, where we look at preparing and using carpentry and joinery portable power tools.

Using a range of hand-held drills

One of the most difficult things to master when you are using any type of drill is keeping it straight. This is particularly true of hand-held drills, where you are turning something with one hand and guiding with the other.

You may need another person to tell you whether you are still in alignment.

For most carpenters a twist drill can be used for smaller holes up to around 10 mm. For larger holes they would tend to use a hand brace.
Types of bits
You should refer back to earlier in this chapter to refresh your memory about the range of bits that are used to drill holes in timber and manufactured products.

Damage to timber and the best methods of drilling through timber and manufactured products
Whenever you are drilling through timber, whether it is a board or sheet, there is always the danger of breakout or splintering on the opposite face to where you are drilling. There are two ways to avoid this:

- Drill through one face until you can see the tip of the bit appearing on the opposite side of the timber. Then reverse the timber and, using the small visible hole, position the bit on the side it came out of and complete the bore hole.

- Find a piece of wood and clamp it to the back of the piece of timber or board that you are drilling. Bore through your timber or board, straight into the waste wood underneath. If there is any splintering or damage then it will affect the waste wood and not your timber or board.

Holding devices
Vices, clamps (clamps are also known as cramps) and jigs can be very useful in holding the material that you are working on. They give you a spare hand. Refer to Chapter 4 for more information about holding devices.
USING WOOD CHISELS

As we have already seen, there are various different types of woodworking chisels. Each of these has a particular job or jobs. The other main tool that is most closely associated with a chisel is the mallet. They are made completely from wood or have rubber heads. The mallet is a joiner’s tool and is used for driving chisels into timber to cut joints. Most mallets are made of beech wood.

Forming recesses and mortises using woodworking chisels

In Chapter 4 we looked at the different ways in which recesses and mortises can be created using hand-held woodworking chisels.

In the last section of this chapter, there are practical tasks that explain how to cut a mitre using a saw and then to form recesses and mortises using the appropriate wood chisel.

USING CARPENTRY AND JOINERY HAND TOOLS

This series of four practical tasks show you how to use saws, planes, drills and chisels.

It is assumed that before starting you have prepared your work area appropriately and are wearing relevant PPE including boots.

Using hand saws

Hand saws are used to cut and shape timber. This practical task will show you how to use a range of different types of saw and how to achieve different types of cuts, across and with the grain. It will also show you how to cut and shape manufactured board and how to cut mitres to given instructions.
**6. USE WOODWORKING HAND SAWS**

**OBJECTIVE**
To use a variety of woodworking hand saws.

**PRACTICAL TASK**

**STEP 1** Mark a face side and edge on the timber.

**STEP 2** Measure and mark the length required and mark it with a pencil and try or combination square.

**STEP 3** Place a bench hook on the bench and rest the timber against the fence.

**STEP 4** Hold the tenon saw with your index finger on the side of the handle pointing towards the brass back of the saw.

**STEP 5** Hold the timber against the fence of the bench hook with the palm of your free hand applying the pressure and your fingers holding the back of the fence. Your thumb should be free to guide the saw when starting the cut.

**TENON SAWS OR BACK SAWS**
These are bench saws and are available in both cross-cut and rip versions. Most carpenter/joiners will only own a single tenon saw that performs both operations. They are available with between 10 and 14 tpi.

**CROSS-CUTTING (TENON SAW)**

**STEP 1** Mark a face side and edge on the timber.

**STEP 2** Measure and mark the length required and mark it with a pencil and try or combination square.

**STEP 3** Place a bench hook on the bench and rest the timber against the fence.

**STEP 4** Hold the tenon saw with your index finger on the side of the handle pointing towards the brass back of the saw.

**STEP 5** Hold the timber against the fence of the bench hook with the palm of your free hand applying the pressure and your fingers holding the back of the fence. Your thumb should be free to guide the saw when starting the cut.

**PPE**
For this and the tasks that follow, ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1. No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.

**PPE**
For this and the tasks that follow, ensure you select PPE appropriate to the job and site where you are working. Refer to the PPE section in Chapter 1. No gloves are worn in these pictures, in order to clearly show how to use hand tools. However, you should wear gloves and other PPE required by your college or employer.
**STEP 6** Place your thumb against the line and the saw against the thumb; then draw the saw backwards to create a kerf in the timber on the arris closest to the fence.

**STEP 7** Push the saw through the timber, applying both forward and downward pressure simultaneously. Do not try to force the saw through, but let the saw teeth do their work, using the full length of the saw.

As the cut is made, ensure your index finger on the back of the saw and the line of the cut are aligned by sighting through all three.

**PRACTICAL TIP**

The saw should be sloping away from you when you start the cut. As the cut progresses the saw will flatten, and as the cut is completed the saw should be angled upwards and the speed of cut slowed.

**STEP 8** When the cut is complete lay the saw down, ensuring that the teeth do not come into contact with any other tools as this will blunt the saw.

**CROSS-CUTTING (TENON SAW)**

**STEP 1** Place the timber in the vice. For longer cuts place the timber on a saw horse and hold it in place with your knee. This should be the right knee if you are right-handed and left knee if you are left-handed.

**STEP 2** The timber should be held at an angle if cutting in a vice.

The saw should be held at an angle if cutting on a saw horse.

**PRACTICAL TIP**

**STEP 1** Place the timber in the vice. For longer cuts place the timber on a saw horse and hold it in place with your knee. This should be the right knee if you are right-handed and left knee if you are left-handed.

**STEP 2** The timber should be held at an angle if cutting in a vice.

The saw should be held at an angle if cutting on a saw horse.
**Step 1**
The work should be supported across two saw horses.

**Step 2**
Mark the cut on the timber.

**Step 3**
Start the cut as for tenon saws, supporting the work with your knee and keeping the saw at an angle of around 60°.

**Step 4**
When ripping long deep sections of timber it is often necessary to wedge the cut to prevent the timber trapping the blade.

**Step 5**
The saw horses will need repositioning as the cut progresses.

**Cross-cutting (Hand Saw)**

**Step 1**
Place the timber across two saw horses.

**Step 2**
Measure and mark the cut.

**Step 3**
Hold the saw at approximately 45° and make the cut as for tenon saws. Support the weight as the cut is completed to prevent the timber from breaking and damaging the cut.

**Rip Sawing (Hand Saw)**

**Step 3**
With longer cuts the end of the timber should be supported as the cut progresses.

**Step 4**
Follow Steps 6 to 8 for Cross-cutting, above, until the cut is complete.
**CUTTING SHEET MATERIAL**

**STEP 1** Lay battens across two saw horses to provide support for the sheet.

**STEP 2** Lift the sheet onto the battens. For full sheets this is best done by two people to prevent injury and also to prevent potential damage to the sheet.

**STEP 3** Measure and mark the cut on the face side and make the cut.

**STEP 4** The battens and saw horses will often have to be repositioned as the work proceeds.

**STEP 5** Clean the cut edge using a smoothing plane and remove the splinters from the underside.

**PRACTICAL TIP**

It is has become common practice to use hard point saws for all the above operations. These are throw-away saws and cannot be sharpened; they are not as cost effective as a good quality, well-maintained saw that can be set and sharpened time and again throughout its life.

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**7. USE WOODWORKING HAND-HELD PLANES**

**OBJECTIVE**

To use woodworking planes to plane timber straight, square and to size, in this and the tasks that follow.

This practical task shows you how to use woodworking planes to plane timber straight, square and to size, using a range of different types of plane.

**PREPARING A FACE SIDE AND FACE EDGE**

**STEP 1** Examine your timber. Select the best side and edge, considering the slope of the grain and any knots.

**STEP 2** Place the timber in the vice or against a bench stop with the grain running in the right direction.

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Figure 5.62 When timber requires support

Figure 5.63 Marking the cut

Figure 5.64 The sheet on the battens to make the cut

Figure 5.65 Note the direction of the grain
**PRACTICAL TIP**

Goggles may be required to avoid damage to your eyes from sawdust. Check with your college or employer.

**STEP 3** Make sure the blade is parallel to the sole of the plane by aligning them using the adjustment lever. Then fully retract the blade so that there is no set on the plane.

**Figure 5.66** The blade should be parallel to the sole

**PRACTICAL TIP**

’Set’ refers to the amount of blade that extends beyond the sole of the plane. This determines the thickness of the shaving that will be removed.

**STEP 4** Adopt a well-balanced stance with your weight behind the plane.

**Figure 5.67** Adopting a well-balanced stance

**STEP 5** Place the plane on the work piece, applying pressure to the tote at the front of the plane and push the plane forward.

Gradually wind out the blade until it begins to bite into the work as the pass is made.

When the plane is in the centre of the piece your weight should be evenly spread at the front and back of the plane. As you get to the end of the piece transfer pressure to the handle at the back.

**Figure 5.68** Transfer of weight

**PRACTICAL TIP**

When setting up the plane in Steps 4 and 5, a scrap piece of wood can be used before starting on the actual work piece.
**STEP 6**  Keep passing the plane across the piece and adjusting the blade until the required thickness of shaving is obtained. Aim to produce a continuous shaving – that is the full length of the piece and the full width of the blade. This should be as thin as possible.

*Figure 5.69  A continuous shaving*

**STEP 7**  Start by planing a face side on the piece. If the timber is rectangular in section this will be one of the widest sides. After making sufficient passes to obtain a smooth finish the face should be checked for wind (twist).

**PRACTICAL TIP**  *‘Wind’ is pronounced wined as in ‘wined and dined’.*

**STEP 8**  Place winding sticks at either end of the piece of wood and sight through the sticks. If the face is flat the sticks will be parallel. If the sticks are out of line the face is in wind.

*Figure 5.70  Checking for twist*

**STEP 9**  If the sticks are out of line, identify the high spots and remove with the plane until a flat surface that is free of wind is obtained. Finish with a single pass across the entire face.

*Figure 5.71  Marking the high spots*

**STEP 10**  Mark the face side with a face side mark.

*Figure 5.72  Removing the high spots*

**STEP 11**  Use the same planing technique for the face edge. The winding sticks are not used for this stage; check that the face edge is square to the face side with a try square.
8. PLANE TIMBER TO GIVEN SIZE

Having produced a face side and face edge on the timber, it is now possible to plane the timber to a given section size.

**STEP 1** Set a marking gauge to the required width with the stock of the gauge on the face edge. Mark the width on to the timber by running the gauge down the length of the timber on both the face side and the back of the timber.

**STEP 2** Place the timber in the vice and plane down to the gauge lines until the burr begins to separate from the edge of the timber. Then make a final pass to bring the timber to size.

**STEP 3** Set a marking gauge to the required thickness. With the stock of the gauge on the face side, mark along the face edge and the back edge.

**STEP 4** Repeat Step 2.
Rebates and grooves can be formed with the use of a rebate plane and a plough or combination plane respectively.

9. FORMING REBATES AND GROOVES

**STEP 1** Set the depth gauge and fence to the depth and width of the proposed rebate.

**STEP 2** Check that the blade is projecting out from the side of the mouth of the plane by about 1 mm. This will ensure a square corner. Rebate planes are fitted with a scribing blade called a spur, which is essential when rebating across the end grain. However, it can also be used when rebating in length if required.

**STEP 3** Place the timber in the vice horizontally. Begin at the end furthest away from you and gradually work the rebate back towards you until the depth stop prevents the plane cutting further. It is essential that the plane is kept tight against the side of the work piece to prevent the rebate creeping out.

**STEP 4** If the rebate is slightly out of square it can be corrected using a shoulder plane, taking care not to exceed the rebate dimensions.

**Figure 5.79** Setting the depth gauge and fence: rebate plane

**Figure 5.80** Setting the depth gauge and fence: plough/combination plane

**Figure 5.81** The blade should project by about 1 mm

**Figure 5.82** Using the plane to form rebates

**Figure 5.83** Forming the rebate
GROOVES
Grooves are formed in much the same way as rebates, using a plough or combination plane.

STEP 1  Set the depth stop to the required depth.

STEP 2  Set the fence to the required distance in from the edge of the piece.

STEP 3  Place the timber in the vice. Begin at the end furthest away from you and gradually work the groove back towards yourself until the depth stop prevents the plane cutting any further. Keep the fence tight against the work piece.

STEP 2  Work the plane with the grain, taking care over cross grain. The blade needs to be extremely sharp to ensure a good finish. Do not attempt to remove too much material with each pass.

PLANE CURVED TIMBERS
Compass planes and spokeshaves are used to clean up internal and external curves. The compass plane is a specialised plane and most carpenters/joiners will not have one in their toolbox. Some joinery manufacturers will have a compass plane in their tool stores for general use; however they are becoming less common due to mechanisation.

STEP 1  Using the adjustment knob on the top of the plane, set the curve of the compass plane to match the internal, concaved or external curve to be cleaned.

Figure 5.84 Using the compass plane to make a concave shape

Figure 5.85 Using the compass plane to make a convex shape
10. USE A RATCHET TO DRILL HOLES

OBJECTIVE
To use a ratchet to drill holes and produce a mortise.

STEP 1 Mark out the position of the mortise and its centre line.

STEP 2 Select an auger bit that is the width of the mortise and insert it into the jaws of the brace.

STEP 3 Mark the required depth of the mortise on to the side of the bit (auger) using masking tape or a timber dolly.

STEP 4 Secure the work piece.

STEP 5 Make sure that the ratchet is not engaged on the handle of the brace and that it is in the fixed position.

STEP 6 Place the auger at one end of the mortise and bore the first hole by turning the brace handle clockwise, maintaining a constant pressure on the brace.

STEP 7 Repeat at the other end of the mortise.

STEP 8 Bore a series of overlapping holes between the outer holes.

STEP 9 Complete the mortise with chisels.

PRACTICAL TIP
The ratchet facility on a carpenter’s brace is for boring holes in confined situations where the handle cannot complete a 360° sweep. The bit cuts as the handle is turned clockwise, but when this action is prevented, the handle is turned anticlockwise and the ratchet allows the bit to stay at its correct depth. When the handle is turned clockwise again the bit cuts deeper and the process continues until the hole is bored. When the bit is to be removed the ratchet is switched to the other side and with each sweep the bit extracts itself from the hole.

Figure 5.86 Boring a series of holes

Figure 5.87 Using chisels to finish off

Forming recesses

The following practical task discusses how to create recesses using wood chisels. It refers you to other practical tasks throughout the rest of this book that are relevant here.
11. USE WOODWORKING CHISELS

The golden rule when working with any chisel is that both hands should always be behind the cutting edge. There are three main operations that are carried out with chisels:

1. Horizontal paring
2. Vertical paring
3. Chopping

**HORIZONTAL PARING**

Horizontal paring can be executed in two ways: across the grain and with the grain.

When you are forming hinge pockets, housings, half laps and so on, the chisel should always be used across the grain.

When running in chamfers, working into rebated corners and forming gun stock shoulders the chisel is used with the grain.

For examples of using horizontal paring across the grain see the practical exercises for producing basic woodworking joints, half laps and housing joints on pages 131, 133 and 136.

**VERTICAL PARING**

Vertical paring is used when working across the end grain. The chisel needs to be extremely sharp.

Examples of vertical paring are the removal of waste material between tails and pins on dovetail joints and the adjustment of shoulders on tenons, although this is better done with a shoulder plane or side rebate plane.

For an example of using vertical paring across the end grain, see the practical exercise on producing basic woodworking joints for dovetails on page 147.

**CHOPPING**

Chopping refers to the action of cutting through timber with the chisel across the grain while working to a depth, such as in mortising. This can be part or all the way through.

For an example of using chopping see the practical mortise and tenons on page 142.
1. Which of the following is the first stage of sharpening and maintaining a saw?
   a. Setting
   b. Shaping
   c. Topping
   d. Dressing

2. How should the saw be angled when cross-cutting with a tenon saw?
   a. Keep the saw flat throughout the cut
   b. Start with the saw sloping upwards, then angle it downwards
   c. Start with the saw sloping away, flatten as you cut and end with it angled upwards
   d. Angle the saw upwards if sawing softwood and downwards if sawing hardwood

3. Which saw is useful for cutting the shoulders of joints and cross-cutting?
   a. Cross-cut saw
   b. Panel saw
   c. Rip saw
   d. Tenon saw

4. What angle should you cut at if cross-cutting on a stool?
   a. 20°
   b. 45°
   c. 60°
   d. 90°

5. Which type of plane can be used to create grooves in timber and also be used for rebates?
   a. Block plane
   b. Shoulder plane
   c. Plough plane
   d. Jack plane

6. Which type of drill bit is used with a ratchet brace to create flat-bottomed holes?
   a. Expanding bit
   b. Irwin bit
   c. Centre bit
   d. Forstner bit

7. Which of the following types of saw has the highest number of teeth per inch?
   a. Rip saw
   b. Dovetail saw
   c. Cross-cut saw
   d. Panel saw

8. What is the term used for the amount of blade that extends beyond the sole of the plane?
   a. Set
   b. Lug
   c. Waste
   d. Point

9. Which of these is not a true statement about sharpening augers?
   a. Use the same number of strokes on opposite spurs
   b. Do not use a forward and backward motion
   c. File in the direction of the cut
   d. Allow the file to touch the cutting edge of the auger

10. Which of the following is true when working with chisels?
    a. Blunt chisels are safer and easier to use
    b. Always hold the chisel in just one hand
    c. Both hands must be behind the cutting edge
    d. Chisels must never be hit with a mallet