

# Knowledge organiser 1: Resistant Materials

There are many different tools for marking out timber:

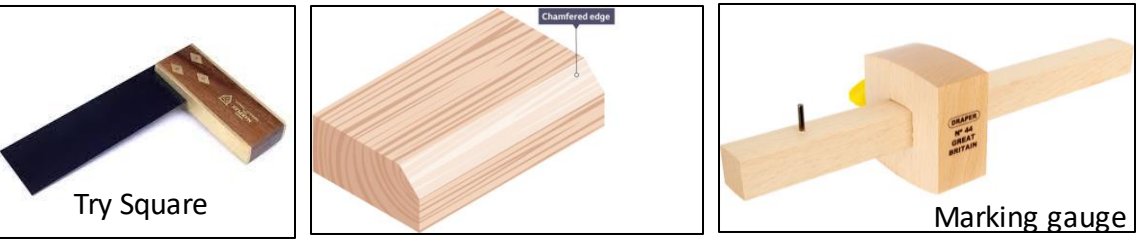
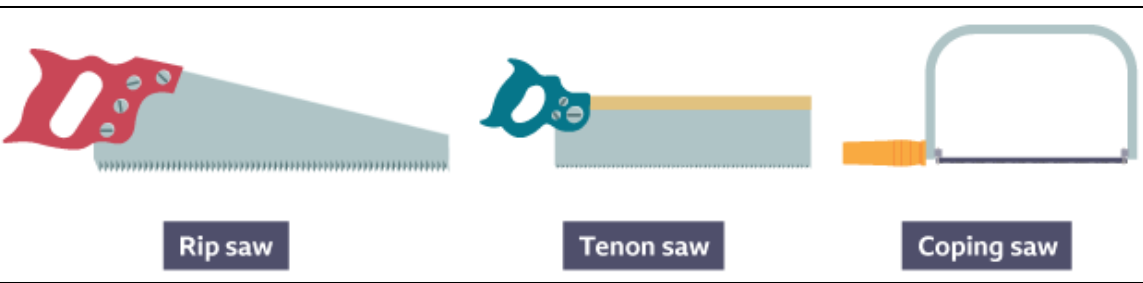
- pencil - the most popular, can go blunt with use and needs to be kept sharp
- marking knife - produces a fine crisp line that can be cut to, will produce many lines on timber before it needs to be sharpened again

**Marking tools**  
 The measuring tools associated with timber are used to measure lengths and angles. The most common tools are:

- ruler - for measuring shorter lengths, widths and thicknesses
- tape measure - for measuring long distances, particularly in the building trade
- try square - for marking out angles that are 90 degrees to an edge
- mitre square - for marking out angles that are 45 degrees to an edge
- sliding bevel - to mark an angle that you set to an edge
- marking gauge - to scratch a line that is parallel to an edge
- mortise gauge - to scratch a set of parallel lines to an edge

**Tools**  
 There are a great many saws used to cut timber - some suit long straight cuts on thicker planks, and others suit curves and complex shapes:

- rip saw - for 'ripping' through and rough cutting thicker planks and boards
- tenon saw - for cutting straight lines with accuracy
- coping saws, jig saws and scroll saws - all for cutting thinner pieces of timber and they can cope with curves too



**Key terms:**  
**Aesthetic** Relating to beauty and visual appearance



As well as marking, cutting and drilling, there are other skills to develop to shape timber:

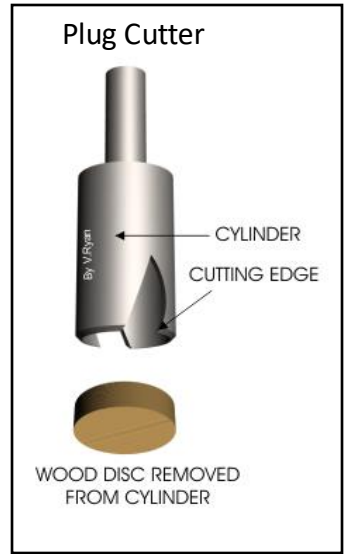
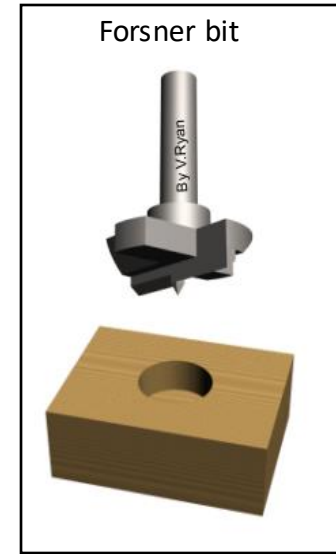
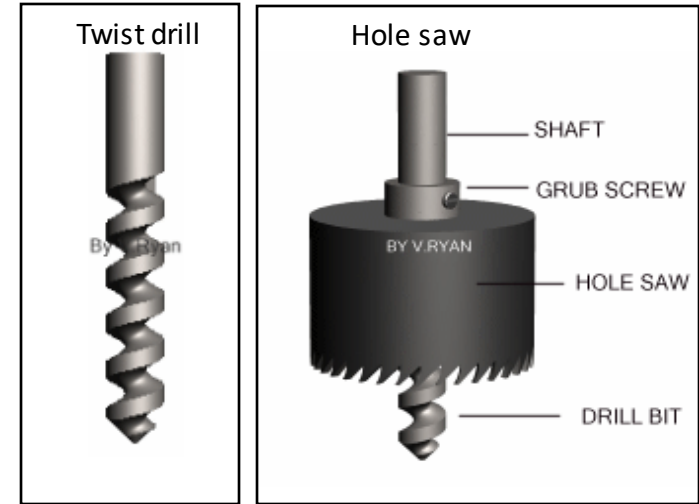
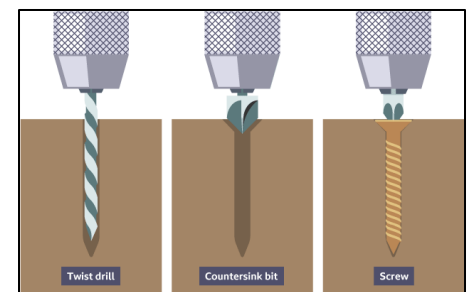
- chiselling** - used to remove timber, usually up to a cut or between two cuts, eg in the production of wooden joints such as dovetails
- planing** - used to smooth the edge of a piece of timber by running a sharp blade in the direction of the grain, or can be used at an angle to produce a chamfered edge
- sanding** - used to achieve a profiled shape or smooth surface finish by removing fine particles, normally the final stage in shaping the timber and done by hand or with a machine (belt, disc or orbital)

**Chisels**  
**BEVEL** edged chisels are slightly undercut making them easy to push into corners. They are normally used for finishing dovetail joints.  
**FIRMER** chisels have a blade with a rectangular cross-section. This means that they are stronger and can be used for tougher/heavier work.  
 A **PARING** chisel is a longer, thinner chisel which can be pushed into long joints such as housing joints. It is used for cleaning up the joint and to make it an accurate fit.



**Drill bits**  
 Timber can also be drilled by using a variety of different drill bits, which work by twisting into a piece of timber:

- twist drills - used to simply drill a hole of a fixed diameter into a piece of timber
- countersink bits - used to profile a hole so that the top of a screw can sit flush with a surface



**Hardwood**  
Hardwoods come from **deciduous** trees, which have large flat leaves that fall in the autumn. Hardwoods take longer to grow, are not easily sourced and are expensive to buy.

Hardwood	Physical properties	Working properties
Ash	Pale coloured, narrow grain	Flexible and good for steam bending, tough, used for sports equipment
Beech	Slight pink tint, close grain	Tough, durable and smooth to finish
Mahogany	Dark-reddish colour, very close grain	Cuts and polishes easily, gives a fine finish, used for high-quality furniture
Oak	Moderate-brown colour with unique and attractive grain markings	Tough and durable, polishes well, used for quality furniture
Balsa	Pale and wide-spaced grain due to it being a fast-growing hardwood	Very soft and easy to form, often used to make models

**Softwood**  
Softwoods come from **coniferous** trees. These often have pines or needles, and they stay evergreen all year round - they do not lose leaves in the autumn. They are faster growing than hardwoods, making them cheaper to buy, and are considered a **sustainable** material.

Softwood	Physical properties	Working properties
Larch	Pale coloured with a contrasting darker grain, knotty	Durable, easy to machine, high sap content gives it good water resistance, used for exterior building and flooring
Pine	Pale coloured with aesthetically pleasing grain	Lightweight, easy to form, used for construction and decking
Spruce	Pale cream with an even grain	Easy to form, takes stain colour well, used for construction and furniture



Most polymers are formed by processing **crude oil**. Rubber is a plastic that is found naturally.

**Thermofforming** polymers can be heated and formed repeatedly. They are **pliable** and **recyclable**.

**Thermosetting** polymers are **brittle** and can only be formed once. They are hard to recycle. They are good **insulators** and are resistant to heat and chemicals.

**Finishing materials**  
Finishing has two separate functions – either to protect the item, or to provide an **aesthetic** quality to the item. When working with any material it will suffer marks from marking-out and construction that will effect the overall appearance of the finished item. To combat this finishing techniques are used to make the final item more aesthetically pleasing. Other finishes, such as applying paint, polish, or **lacquer**, and also protect materials from further damage and marks.

To find out more:  
<https://www.bbc.co.uk/bitesize/guides/zh4g4qt/revision/1>  
<https://www.bbc.co.uk/bitesize/guides/zjgyb82/revision/1>

**Selecting Materials**  
Once the design engineer has taken into account all of the physical and working properties of the material, they should address these areas:

- Functionality** - Does the material perform in the way that is required?
- Aesthetics** - What does it look and feel like?
- Environmental considerations** - What impact does it have on the environment during extraction and processing? Does it require chemical treatment and can it be recycled?
- Availability** - What **stock forms** does it come in and are they fit for purpose?
- Social, cultural and ethical considerations** - Does the material have any a special cultural value or come from an endangered or unethical source? What were the working conditions for those extracting the material? Are there social trends that the material contradicts, eg the use of single-use plastics?

