Technology 7–8 – Materials and production processes (timber)

My BBQ rules (20-week unit)

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# Introductory skills task – the sign

The sign is designed as a short introduction to the workshop, workshop safety and using hand tools. It is a practical activity to initiate skills and concept development for Technology 7–8 students in a timber workshop setting.

Students develop their own sign from available timbers provided by the teacher. It is a good opportunity for teachers to clear their timber scrap or offcuts box.

## Steps in production

Discuss with students where they could use a sign in their own environment. Suitable locations may be:

* their desk
* their bedroom door
* the front of their house
* the letter box.

Identify the constraints affecting their design. For example:

* width of a door – the sign may not be longer than 720 mm or the door may not close.
* aesthetics – Would a sign 700 mm long appear too big for the door?
* available materials – Is timber this long available? If not, what is a suitable purpose and location for the sign?

Consider where students will display their sign. If it is to hang on a surface, small eyelets may be screwed in the back and picture hanging wire attached. If it is to stand on a surface, a simple stand may be bent from metal sheet, or shaped from scrap timber, and attached to the back of the sign.

|  |  |
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| Instruction | Reference image |
| Issue students with their piece of timber. This is a good opportunity to use the offcuts produced in the timber workshop. |  |
| Students write their name on the best side of the timber (**Note:** use a prompt question, for example, ‘What makes the best side?’).  Using a try square, check your selected edge is square to the face. Aim your timber towards a light, place the try square stock hard against the timber face and lower onto the edge. If light is not visible under the blade, the edge is square to the face. Check it in at least 3 spots along the edge.  Students mark the ‘face side’ and ‘face edge’. |  |
| Students complete the sign working drawing activity, adding dimensions and material information. For Year 7 students, keep the measurements to increments of 5 mm, this will make it easier for students to identify. |  |
| Students draw the display or adornment they would like to put on their sign. Use a scale of 1:1, if possible, or a scale 1:2. Emphasise the use of scale. |  |
| Close to one end (3–5 mm), mark a try square line across the timber. Using an engineer's rule and try square, mark out the sign to length, allowing 3–5 mm of waste at either end. Mark waste with crosses. |  |
| To remove excessive waste, use the blade of a marking knife to cut the top fibres of the grain on the waste side of the line, ready for cutting with a tenon saw. |  |
| Using a tenon saw and a bench hook remove the excess waste. (**Note:** this can be a teaching point – using a pistol grip with tools).  Two bench hooks may be used to support the timber being cut. |  |
| Disc sand to the marked lines. Use a try square to check that the end is square. |  |
| Mark out the chamfered edge. A pencil gauge measuring 5 mm may be made and used. Mark out the face, both edges and ends. |  |
| A good skill for students is to learn to use their fingers as a pencil gauge. Hold the pencil between the thumb and index finger (pointer) and steady the pencil tip to width using the middle finger. This skill requires practise to master. Practise on scrap timber to gain confidence. |  |
| Plane the chamfer. Start on the ends.  **Note:** planing end grain requires special attention. Planing across the end grain may result in splits if performed incorrectly.  Holding the jack plane on an angle as shown and planing the end with the grain is one method to achieve a planed chamfer. Demonstrate using a pistol grip to hold the plane (index finger pointing down towards the blade) to steady and lock the wrist |  |
| Plane the edges along the grain. Plane with the grain to achieve a smooth edge. |  |
| Prepare for finish using an abrasive. Use a cork block and sand in the direction of the grain. Sand initially using 80–100 grade abrasive. Follow up by sanding with 180 grade to finish. | Sanding |
| Transfer selected adornment to sign. If coloured using pencils, the design can be traced using a ball point pen into the timber. |  |
| Alternatively, adornment can be developed as a graphic, engraved with a laser engraver or a printed design ironed onto the timber. Iron on design methods work best on closed grain timbers such as Huon pine. Text must be reversed for this process. Prepare using presentation software. Use a screen capture application, such as the snipping tool to capture a graphic of the design and flip the graphic to reverse the image, readying it for ironing. |  |
| Apply clear finish to the sign. When dry, lightly sand with the grain using 180–320 grade abrasive and apply a second coat. |  |

# The BBQ caddy

The BBQ caddy introduces a range of skills essential to the production of quality timber artefacts. The project builds on skills developed in the production of the sign, including marking out, sawing timber and finishing. [Explicit teaching strategies](https://education.nsw.gov.au/teaching-and-learning/curriculum/explicit-teaching/explicit-teaching-strategies) are integral in the delivery of this project.

The project provides opportunity for substantial student input. The examples given in this document provide a step-by-step guide in production leading to student success for a variety of student abilities. With more proficient cohorts, all aspects of production may be reviewed, changed and documented to suit individual student’s personal circumstances. Suggestions will be made for design changes throughout this document.

Napkins come in several sizes. The teacher should purchase a packet of napkins that fit the project to demonstrate to students. When projects are sent home, students can be supplied with a small number of napkins to present their work.

## Steps in production

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| --- | --- |
| Instruction | Reference image |
| **Selecting timber**  Mark out sides and ends, using marking out tools. Mark out sides and ends in the sequence of joins to maintain the grain structure. Leave a waste gap of 3–5 mm to cut pieces to length. |  |
| Using a tenon saw and bench hook, cut the pieces to length. Cut through the crosses in the waste gaps. Review cutting techniques with students and emphasise the use of a pistol grip. |  |
| Pair sides to check the lengths. Pairing can also be used to mark out housing and rebated butt (Rabbet) joints. |  |
| Mark out the handle. In shaping the handle, allow distance from the edge of the handle shape to avoid splitting the handle along the grain. |  |
| Teachers may consider making a template for students to mark out the handle. |  |
| **Preparing the handle joint**  A housing joint of ½ T (half the thickness) will be cut into the sides. To align the handle to the full width of the project, ½ T from each end of the handle to the height of the sides. In this case 13 mm thick timber is used. This means that a rebate of 6 ½ mm is cut. |  |
| The tenon saw can be used to remove the rebate. Keep all saw cuts straight down in the vice. Reemphasise to students the use of a pistol grip with tools. |  |
| Set up the spade bit in the pedestal drill vice. Clamp into position.  Recheck position before commencing drilling. |  |
| To cut the traditional handle, draw a line tangent to the circumference of the bored holes and cut in a vice using a coping saw. Finish off the inside of the handle using a second grade or smooth file. In this example, the 32 mm spade bit provides ample space for 2 fingers. A variation that is achievable for lower-ability students. |  |
| Cut to shape using a tenon saw. Secure work in place on a bench hook using a clamp. Quick-release clamps are good for this task.  Alternatively, a mitre saw could be used if available. |  |
| The shape can also be cut placing the part in the vice and cutting through the part in a downward motion. Ensure the part is aligned so the part can be cut straight down. Keep the cut close to the vice to avoid possible splitting along the grain.  As the cut approaches the vice, move the part higher in the vice. |  |
| Finish shaping using machine sanders. A disc sander can be used for shaping outside curves. An oscillating spindle sander may be used to sand inside curves. Follow the safety guidelines as outlined in [Equipment Safety in Schools](https://education.nsw.gov.au/inside-the-department/facilities-assets-and-equipment/school-infrastructure-nsw/knowledge/directorates/operations/technical-services/compliance-and-environment/equipment-safety-in-schools/equipment-advice). |  |
| Mark out the halving joint to house the handle. Pair the sides to check that marking out is aligned. Remember to mark out ½ T for the depth of the joint. In this case it will be 6 ½ mm deep. |  |
| Cut to depth using a tenon or dovetail saw. Support sawing using bench hooks. Remove the waste using a chisel and mallet. Here the chisel used is 12 mm. Always work towards support, either by chiselling towards the middle and turning timber around, or by chiselling timber into waste (or in this example, the bench hook support). |  |
| Dry fit the handle into the side housings and check for fitting. |  |
| In the design stage, students should select the method of holding down the napkins. This example uses a decorative steel section, recycled from a broken lampstand as the paper weight. The section will be housed in the sides of project. Using this method, 22 mm dowels could also be used. Student input in the paper weight design will produce some interesting solutions. |  |
| On each side, mark out the position of the napkin holder. Use a 25 mm spade bit. Calculate and mark the centre of the spade bit to ensure at least 15 mm of the side is left intact.  Pair the sides to check prior to drilling.  Set up the spade bit and clamp the side into position. Drill the hole. |  |
| Using a try square, mark a line from the timber edge to the outer circumference of the drilled holes. Mark lines on the edge and the other side. Mark as waste. Use a tenon saw to cut on the inside of the line into the holes. |  |
| Finish the recesses using a flat second cut or smooth file for the sides and a round file for the remaining hole. Complete the task by sanding. Use a small piece of abrasive wrapped around a pencil or round file and sand smooth. |  |
| Sand all parts in a forward motion, sanding along the grain. Pay particular attention to the inside of the project. It is easier to sand these now before the project is assembled. Initially, use 80–100 grade abrasive and then finish with 180–240 grade abrasive. Remember, the grade of the abrasive is written on the back of the sheet. |  |
| Dry fit the project ready for assembly and gluing. |  |
| Assemble and glue project. Protect the bench with plastic. Apply PVA glue to all joined surfaces. For the napkin end cut a temporary spacer from scrap and fit (do not glue). Apply pressure to the joints using sash clamps or quick release clamps. Check that it is square, using a try square and measuring diagonals, as shown in the images.  **Note:** if the opposite diagonals are the same size, the project is square.  Wipe excess glue from the project using a damp cloth. Wrap the cloth around a sharp tool, such as a scriber to remove glue in tight corners. Allow 24 hours to dry. |  |
| The example here uses a plywood base. The base will be nailed using panel pins to the project. A pencil line may be marked to assist in the placement of the panel pins. At least 4 pins are required on the long sides. Allow at least 20 mm from the ends of the project for the last pins, to avoid splitting the timber. Alternative base shapes can be used including overhanging circular profiles. |  |
| If the fit is acceptable, apply PVA glue to the base edge of the project and hammer panel pins using a Warrington or Cross Pein hammer. As for the initial assembly, remove all excess glue evident. Note the continued use of the spacer while fitting the base. |  |
| Drive panel pins into the base to attach. Stop hammering as the pin head hits the plywood. Use a hammer and a nail punch to finish off, to avoid bruising the surface of the timber with the hammer face. |  |
| The assembled project with attached base. Notice the base is slightly bigger than the project and can be planed back to size with carefully using a sharp fine blade set in the jack plane. With the project held in a vice, students can rest the sole of the plane on the project sides and observe the position of the blade through the mouth of the plane, to ensure the blade is only touching the plywood base. Care is required. |  |
| Prepare for finish. Sand using abrasives. If prior sanding has been completed, sand with the grain using 240–320 grade abrasive, taking care to sand with the grain. |  |
| Apply finish. The most suitable finish for years 7–8 students is wipe on water-based Polyurethane. Another option is to lightly apply Polyurethane using craft sponge brushes. Apply to the end grain first and carefully remove all excess. Apply coats with the grain starting from the middle of the surface and working towards the ends.  When dry lightly sand with 240 grade abrasive and recoat. A minimum of 2 coats should be applied.  **Note:** if using an open-grained timber, such as Meranti or Pacific Maple, it is necessary to ‘raise the grain’ prior to applying the finish.  Before applying the finish, dampen the surfaces of the project and allow to dry. Outline to students how the dry object is now rough, as the grain ends pushed into the open grain are wet and stand up on drying. Raising the grain will provide a smoother final finish. An oil finish could be used, but it is not suited to a project that may be used outside and subject to liquid spills |  |

### Alternative solutions

The project provides opportunity for in individual student input in the design and production of the project. In delivering the project and developing student skills and knowledge a range of final products may be produced following instruction in a common set of skills.

 

A rounded base, made from solid timber or plywood is decorative and attractive when serving at a gathering. While a round base presents different challenges in student production it could easily be fitted to the body as it is centred from above and may simply be glued and weights used to produce required gluing pressure. The example on the left displays a paper weight produced by ‘Between centres’, turning on the lathe using a scraper tool, a skill approved for use by Stage 4 students. The example on the right demonstrates a student's input in design and production of the paper weight.

The following example is more a triumph of style over function that builds on skills developed during the production of the sign. To ensure student success, maintain the sizes of the sides and handles as given in the working drawings.

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| Instruction | Reference image |
| This example includes an extra rebate and butt joint as well as the housing joint for the handle. The joints used and the number included in the project may be revised by the teacher dependent on the skills of the student cohort.  A saw cut is marked out the width of the end and ½ T deep on one end. |  |
| **Sides**  Remove waste by placing the side part in the vice and tapping a paring chisel into the timber slightly above the marking out line. Ensure the bevel of the chisel is facing the student’s body. Remaining waste may be pared out by hand, securing the work to a bench hook. Project assembly will be the same as the previous example, however the end will be cut to 1T extra length. |  |
| Locate a suitable graphic for decoration. The graphic used here was resized to suit the handle timber and printed. The graphic dictated the shape of the handle which was marked free hand following location of the graphic on the handle timber. |  |
| Cut shape of handle using a coping saw or a scroll saw (permitted for Stage 4 students under direct teacher supervision). Sand the edge of handle using the disc sander and the oscillating spindle sander, for inside curves. |  |
| Carefully lift the graphic and sand the face. Complete sanding using smooth abrasive. This cannot be completed once the graphic is added. |  |
| Transfer the graphic using a ballpoint pen. Older types with a thick, rounded ball point are perfect. Fill the traced lines directly onto the timber. |  |
| Prepare the paper weight blank for turning. Measure to length, adding at least 25 mm to each end for waste. Square the ends and disc sand. |  |
| Place the blank in the vice and join the diagonals to locate the centre. Complete for both ends. Use a centre punch to punch an indent in the centre.  On one end only, use a tenon saw to cut a small kerf in each diagonal line about 3 mm deep. |  |
| Use a jack plane to remove the square edges of the blank. |  |
| Set the blank on the lathe for between centres turning. The cut grooves attach to the live centre on the head of the lathe. Set the height of the tool post just under centre, so the cutting edge will be at centre. Turning the blank so a planed edge is close to the tool post will aid in setting heights. |  |
| Check everything is tight and turn blank by hand to check obstructions prior to turning on the lathe. |  |
| Using a large gouge or a scraper round the blank to the largest possible diameter. |  |
| Turn the blank to a constant diameter. Measure the useable length. Various features of the required profile can be marked out. Use a parting off tool to reduce diameters and a scraper to shape the profile. |  |
| Complete shaping. Check for fit. Remove the tool post and sand using 100 grade and 180 grade abrasive. |  |
| Apply finish. In this case, the part is painted using craft paints and an art brush. Clear polyurethane is applied over the top. Sponge brushes minimise brush strokes and can be used to control the amount of finish, reducing drips. Note the screw in hook in the stock. These are cheap and provide an easy method to hold the item and hanging to dry. |  |
| The examples given here will provide teachers with a path to student success. Confident and competent teachers need not be constrained by these examples but rather encourage a range of student input into the design and production of the final product. |  |

# References

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