Build a Sawhorse

Description
Carpenters need to be able to accurately interpret drawings in order to extract information. Measuring correctly, cutting accurately, and using fasteners appropriately are necessary skills that every carpenter must develop. In this Activity Plan, students will have the opportunity to develop these skills by constructing sawhorses in small groups.

Sawhorses are indispensable on a construction site and can prove to be constantly useful around the home. Their versatility is shown by their ability to function as workbenches, stepladders, vises, scaffolding, storage racks, seating, and platform and table supports.

Lesson Outcomes
The student will be able to:

• Extract information from a drawing
• Proficiently perform basic measuring and layout
• Cut materials in an accurate and safe manner using appropriate tools
• Join materials together using appropriate fasteners
• Build a sawhorse that can be used in other activities within the course

Assumptions
The student will:

• Have an understanding of measurement systems used in carpentry and the use of tape measures, squares, and basic layout techniques.

• Have had an introduction to the safe use of basic hand tools and portable power tools, including portable circular saws, mitre saws, and hammers.

• Be aware of common fastening devices, including common and finishing nails, wood screws, and wood glue.

Terminology
Gusset (cleat): a strip of wood used to strengthen or support the surface to which it is attached.

Sawhorse: a beam with four legs used to support a board or plank for sawing. Commonly used to support lumber, or as a work surface.

Sliding T bevel: an adjustable gauge for setting and transferring angles.
Estimated Time
3 hours
The time for the activity will depend on the familiarity of students with tools and their access to tools—e.g., the number of mitre saws and portable circular saws available, etc.

Recommended Number of Students
Students will work in groups of 2–4 (2 students are best), depending on class numbers and space available.

20, based on BC Technology Educators’ Best Practice Guide; ideal is 16.

Facilities
Technology education shop facility required. A secure space to work outside is advantageous, as well as open floor area in which to build the sawhorses.

Materials
Note: Material can be partially or completely precut by the instructor in order to facilitate ease of construction. This would be determined by the experience of students in the class, time constraints and the tools available. Legs may be cut to any length to suit the purpose.

The table below lists materials required to construct one sawhorse:

<table>
<thead>
<tr>
<th>Mark</th>
<th>Name</th>
<th>Number required</th>
<th>Measurement (metric)</th>
<th>Thickness</th>
<th>Width</th>
<th>Length</th>
<th>Material</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Legs</td>
<td>4</td>
<td>1 × 6 × 26”</td>
<td>1”</td>
<td>6”</td>
<td>26”</td>
<td>Fir/hemlock</td>
<td>Cut at 4”/24” angle</td>
</tr>
<tr>
<td>B</td>
<td>Top</td>
<td>1</td>
<td>2 × 6 × 42”</td>
<td>2”</td>
<td>6”</td>
<td>42”</td>
<td>Fir/hemlock</td>
<td>Notched at 4”/24” angle</td>
</tr>
<tr>
<td>C</td>
<td>Gussets</td>
<td>2</td>
<td>½ × 11 × 8”</td>
<td>½”</td>
<td>11”</td>
<td>8”</td>
<td>Plywood</td>
<td>Cut to fit</td>
</tr>
<tr>
<td>D</td>
<td>Rails</td>
<td>2</td>
<td>1 × 4 × 48”</td>
<td>1”</td>
<td>4”</td>
<td>48”</td>
<td>Fir/hemlock</td>
<td>Cut to fit</td>
</tr>
<tr>
<td>E</td>
<td>Wood screws</td>
<td>36</td>
<td>1¼”</td>
<td>#8 F.H.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional
• Wood glue
• Finishing nails or wood screws (1¼” #8)
• Sandpaper
Figure 1—Dimensions of a sawhorse

Note: Legs may be cut to any length to suit the purpose.

Tools

- Portable circular saw(s)
- Compound mitre saw(s)
- Measuring tape
- Protractor
- Adjustable T bevel
- Hand plane
- Screwdrivers
- Hammer
- Carpenter’s pencil
- Straightedge
Procedure

1. **Legs:** Select a straight and knot-free piece of 1 × 6” stock for the legs.
   
   b. Lay the framing square on the 6” face of this leg stock, as shown in Figure 2, taking on the tongue (short end) and 24” on the blade (long end) of the square. Draw line #1 along the tongue. This will be the line for the bottom cut of the leg. 
   
   **Note:** The square is held so that the numbers on both tongue and blade are along the same edge of the board.

   ![Figure 2—Laying out the bottom cut](image)

   c. Measure 25” from line #1 along the board and make a check mark (•). Reverse the square as shown in Figure 3 and hold it the same as before (4” tongue and 24” blade). Draw line #2 along the tongue through the check mark. This will be the line for the top cut of the leg. 
   
   **Note:** Lines #1 and #2 for the bottom and top cuts should be parallel to each other.

   ![Figure 3—Laying out the top cut](image)
d. Turn the board on edge and lay out the edge cuts, #3 and #4, as shown in Figure 4, by holding the framing square to the numbers 5¼” on the tongue and 24” on the blade. The tongue of the square should touch line #1, the bottom cut. Draw line #3 along the tongue.

![Figure 4—Laying out the edge cuts](image)

e. Reverse the square and draw the top side cut, line #4, as shown in Figure 4. **Note:** Lines #3 and #4 should also be parallel to each other.

f. Cut lines #1, #2, #3, and #4, sawing on the waste side of the line.

g. As shown in Figure 5, measure up 12" from the bottom cut of the leg along the edge and make a check (✓). From the opposite edge of the board, measure 5” along the bottom and make another check (✓). Use the blade of the square to draw line #5 connecting these two checks.

![Figure 5—Marking off the leg taper](image)

h. Cut line #5, sawing on the waste side of the line.

i. Using a block plane and a file, smooth up the cuts to the lines.

j. Now use this one finished leg as a *pattern*, and trace around it and cut out three more identical legs.

k. Label the four legs A, B, C, and D. Set them aside until assembly, and begin the top.
2. **Top:** Select a straight and knot-free piece of 2 × 6" stock for the top.
   
   c. Use the square to check that one end of the top material is square, and from this end measure 42" along the length and make a check (✓). Draw a square line through this check, and then use a saw to carefully cut along the waste side of this line.
   
   d. To lay out the gain joints, as shown in Figure 6, measure 4" from each end of the 2 × 6" stock and make a check (✓). Draw a square line #1, across the face through each check.

![Figure 6—Laying out the gain joints](image)

   e. Turn the top piece on edge and lay the framing square on this edge, holding the square to the 4" mark on the tongue, and the 24" mark on the blade; the tongue of the square should touch line #1. Draw line #2 along the tongue.  
   **Caution:** Be sure to have the angle in the right direction as shown in Figure 7, angling outward toward the end of the stock.

![Figure 7—Marking the outside edge of the gain joint](image)
f. Place one edge of leg A alongside line #2, so as to get the exact width of the gain joint. Draw line #3 as shown in Figure 8. To the side of line #3, print the letter A to ensure leg A will be attached here during assembly.

![Figure 8—Marking the inside edge of the gain joint](image)

g. For the depth of the joint, measure 3/8" from the edge of the stock and lay out line #4 as shown in Figure 9.

![Figure 9—Marking the depth of the gain joint](image)

h. To lay out the gain joint on the opposite edge of the 2 x 6" stock, take a bevel square and set it to the angle of line #2, and now draw an identical line on the end of line #1 on the other edge of the stock.

i. Place leg B alongside this new line, as in step d, and draw a line showing the width of leg B. Again to the side of this line, print the letter B to ensure leg B will be attached here later.
j. Using the bevel square, and leg C and leg D, lay out the two gain joints on the other end of the 2 × 6" stock. Take care to make each leg angle in the proper direction, as shown in Figure 10.

![Figure 10—Correct orientation of the legs]

k. **Caution:** Before cutting the gain joints, check the lay out for the following:
   - The lines of each joint on the edge of the 2 × 6" stock must angle outward at the bottom.
   - The lines of each joint must be parallel to each other.
   - The width of the joint should not exceed the width of the corresponding leg.

l. Cut out the gain joints with saw and chisel as shown Figure 11. Be sure to cut on the waste side of the line, leaving just the line, to ensure a tight fit for the legs.

![Figure 11—Cut out the gain joints]

m. To prevent splitting, pre-drill the top of each leg with three 3/16" pilot holes.

n. Using the 1¼" #8 F.H. wood screws and white glue, attach each leg to the appropriate gain joint.
3. **Gussets**: Select a piece of $\frac{1}{2}''$ thick plywood measuring 6'' wide by 21'' long.

d. The gussets are wedge shaped, as shown in Figure 12. The angle can be obtained by holding $5\frac{1}{2}''$ on the tongue of the framing square and 24'' on the blade, and drawing line #1 along the tongue, as shown in Figure 13.

**Note**: The same outside edge of the square is used for 2¾'' and 12''.

![Figure 12—Gusset](image1)

![Figure 13—Measuring the gusset](image2)

e. The length of this piece on the long edge is 11''; lay out this distance as shown, and mark with a check (✓). Then using a bevel square set to the 5½/24 angle, draw the angle through the check, marking line #2 as shown in Figure 14.

![Figure 14—Marking the gusset outside edges](image3)

f. Use a saw to carefully cut the first gusset, and then using it as pattern, trace the shape for the second gusset. Now cut out the second gusset.

g. Pre-drill three $\frac{3}{8}''$ holes, $\frac{3}{8}''$ from each of the two sloping edges of the gussets.

h. Stand the sawhorse on end, and using white glue and 1¼'' #8 F.H. wood screws, attach a gusset to the legs, ensuring the top edge is up tight against the 2 × 6'' top. Pre-drilling pilot holes in the edges of the legs will prevent splitting.

i. Reverse the sawhorse and repeat the procedure for attaching the other gusset.
4. **Rails:** Select two straight and knot-free pieces of 1 × 4” stock approximately 42” long.

   e. Set the bevel square to the 4”/24” angle of the gain joints, and then lay out this angle on one end of each piece of 1 × 4” rail stock. Cut this angle.

   f. With the sawhorse standing on all four legs, place a framing square with the blade on the top and the tongue pointing downward toward the floor as shown in Figure 15. On each leg, at a point 12” down from the top, mark a check (✓).

   ![Figure 15—Laying out rail position](image)

   g. To find the rail’s exact length, as shown in Figure 16, place the bevel-cut end of the rail flush to the outer edge of the leg, and with the upper edge of the rail flush to the checks on each leg. Draw line #1 alongside the other leg to indicate the length.

   ![Figure 16—Measuring the rail length](image)

   h. Cut this rail to length along line #1, use it as a *pattern* to lay out the other rail, and then cut it as well.

   i. Use clamps to hold the rails in place, and then pre-drill the rails and legs with three pilot holes. Use white glue and 1¼” #8 F.H. wood screws to attach each rail to the legs.

   j. Finally, test the completed sawhorse by placing it on a true surface or level plane such as a bench top. The sawhorse should be firm and solid when standing on a true surface. Adjust the leg length as necessary, to cure a *rocking* horse.
Activity: Build a Sawhorse

1. Review terminology and safe work practices.

2. Divide the students into groups. Each group of will receive a copy of the plan and generate a material list. (2 ideal—4 students maximum per group). 94 legs, 2 gussets, 2 rails (?), and 1 top).

3. Each group will draw up a full-sized leg pattern and an end gusset pattern. This could be done on paper or directly on the construction material.

4. Students will lay out the patterns on the construction material in order to determine the most efficient use and ease of cutting of the pieces.

5. Each group cuts out 4 legs, 2 rails, and 2 end gussets. A portable circular saw could be used for ripping pieces to the correct width and then cutting to the exact length. A mitre saw could also be used for the length cuts.

6. It may be desirable to hand plane the edges of the top 2 × 6” to the correct angle of the legs. (This is optional depending on the design. An alternative would be for the instructor to rip the edges at the correct angle on a table saw in order to save time.)

7. Students will assemble the sawhorse by placing the legs, rails, and gussets in the correct position and using glue and nails (wood screws can be substituted for greater strength). It is important that students place the components in an accurate position with flush surfaces in order to ensure a successful project.

8. Sandpaper should be used to clean up sharp edges and surfaces.

Evaluation Guidelines

The student:

• Plans the project to organize work and ensure personal safety
• Efficiently prepares the work area and assembles materials/tools (e.g., the student is responsible for a tidy work environment)
• Uses hand tools safely and efficiently to complete the task
• Uses power tools safely and efficiently to complete the task
• Handles and organizes materials in a safe manner
• Maintains an orderly, safe work area while completing the task
• Shows care and attention to work
• Constructs the sawhorse to specifications
  – Angles and positioning correspond to layout
  – Components are cut to correct length
  – All components are flush
  – Sawhorse sits stable on the floor
  – Sharp edges have been removed
• Completes the task within the time allotted
• Leaves the work area in a clean, orderly, work-ready state