

Physics 200

Instrument Construction Directions

Day 1 (Full block):

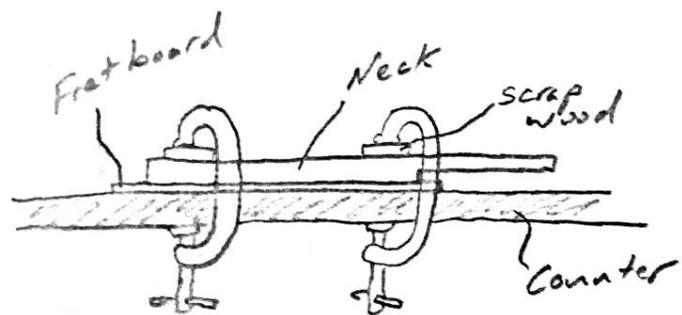
1. Assembling/Gluing the Body:
 - a. Glue the interior neck supports to the inside surface (whichever surface looks uglier) of the body ends. First glue a support to the end with the hole, so that you can see how the support needs to align with the edge of the end piece.
 - b. Lay the bottom or top down, inside facing up. Glue the sides to the bottom and to one another, one side at a time. Glue the top or bottom to the sides.
 - c. "Clamp" the body together using pieces of masking tape. At each edge, press the wood together and stretch a piece of tape perpendicularly across the seam. Allow at least 20 minutes of cure time before proceeding to the next step (longer is better).
2. Assemble and glue the peg box.
 - a. From bottom to top, the pieces go in this order: solid piece, grooved piece, pointy piece, hollow piece.
 - b. Line up the curved edges of the pieces so that the flat front edges form a stair step. Squeeze together, wipe off excess glue, realign if necessary, and "clamp" together with masking tape. Allow at least 20 minutes before using.
3. Learn about standing waves, division of the octave, and fret calculations

Day 2 (Split block)

4. Prepare a neck and fret board.
 - a. Check the fit of the neck in the body. If it does not fit properly, make necessary adjustments.
 - b. Define/prepare the body end of the fret board
 - i. Decide how far you would like the fret board to protrude over the top of the body. Consider where your sound holes will be located.
 - ii. Optional: consider whether you would like to shape this end of the fret board. Use the scroll saw to cut the end of the fret board to the shape of your choice.
5. Finish learning how to do fret calculations

Day 3 (Full block)

6. Glue the fret board to the neck
 - a. With the proper overhang on the body end of the neck, glue the fret board to the neck
 - b. Use clamps for at least 15 minutes. Place the fretboard top-down along the edge of a lab table. Place the neck on top of the fret board. Place two pieces of scrap wood on top of the neck, and compress tightly with C-clamps that touch only the table top and scrap wood. The scrap wood prevents the clamps from damaging your instrument neck.



7. In D104:
 - a. Cut the sound hole(s). Remove the masking tape and cut the sound holes.
 - b. Use the belt sander to sand the body edges and the front of the peg box.
 - i. Rest your instrument body on the platform in front of the sanding belt. The belt will pull your instrument downward, so resting it on the platform will keep it stable.
 - ii. Sand the edges and corners of your instrument body. Don't overdo it! Don't sand the faces of your instrument body with the belt sander!

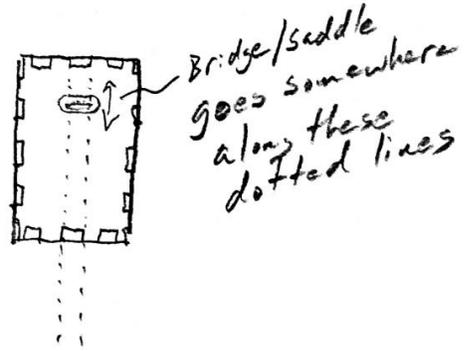
- iii. Sand the front (stair step) edge of your peg box. Following the stair step contour, sand until the surface is planar. It is very important that the surface is perfectly planar, rather than concave or convex.

Day 4 (Split block) -- The most important step to complete today are #10A and #11. Steps 8-9 and 10b are important if you want a specific scale length, and if you want to go ahead and neaten up your instrument, but you need to glue on your peg box at least 5 minutes before the end of class.

8. You can do steps a, b, and c in any order...

a. Determine your bridge/saddle placement.

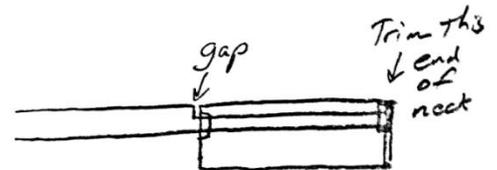
- i. I do this by thumping or tapping the top of my instrument until I have found a location that gives a nice, loud sound. My assumption is that this is the most efficient place to transmit waves from the strings to the body. However, the loudest spot is probably not the strongest spot. Therefore, if you are using steel strings or 6 strings, you may have too much string tension for this location. In that case, you might want to move the bridge closer to the edge of the instrument body.



- ii. Make a pencil mark where you will position your bridge.

b. Trim the body end of your instrument neck.

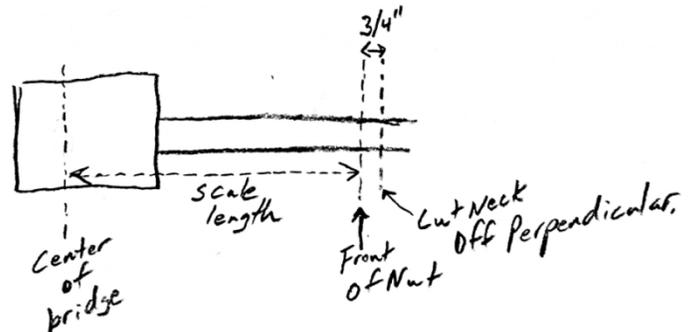
- i. Insert the neck all of the way through your instrument, so that the end fits into the internal support. This is a little bit of a hassle.
- ii. When it is finally seated, you will probably notice a gap between the neck and the body. If this is the case, you will need to cut off a little bit of the neck tip, so that the neck sits flush with the body. Measure the gap. Then remove the neck and cut off a length equal to or slightly greater than that gap.



- c. Decide on your instrument's scale length. A standard ukulele (and a 4/4 violin) has a scale length of about 13". A concert ukulele has a scale length of 15". A standard mandolin scale length is 13 7/8". A viola scale length is about 14 1/2".

9. Mark the neck for cutting off the extra length. Be careful -- it's hard to put wood back together once you cut it off.

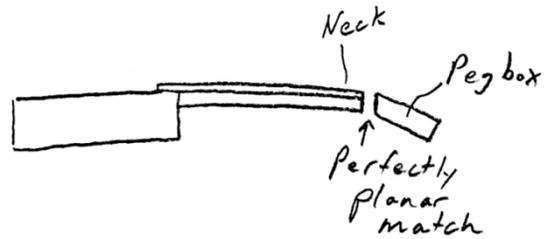
- a. Fully insert the neck into the instrument body so that the end fits in the neck support at the back of the instrument*.
- b. Measure one scale length from your bridge mark toward the end of the neck and make a pencil mark on your fret board. This will be the front of the nut.
- c. Make another mark 3/4" inches behind the nut (opposite the bridge). This is where you will cut off the neck.
- d. Use a miter saw or the scroll saw to cut off the neck with a perfectly perpendicular cut at this location.



10. Optional -- Back to D104 for more sanding?

- a. **Make sure that the end of your neck surface is planar, and that it matches the end of the neck. You may want to use the belt sander to make it perfectly planar. Hold your peg box next to this surface to make sure that both surfaces are planar, and that they match properly.**

- b. Finishing the neck:
 - i. If the edges of the neck and fret board are not aligned, you can use a plane to shave them off evenly.
 - ii. If you want to sculpt the neck (e.g. make it thinner near the peg box), do that now.
 - iii. This is also the best time to sand the neck. You can use the belt sander today.



11. Glue the peg box to the neck.

- a. Use tape to hold it firmly in place.
- b. The weakest part of your instrument will be the junction between the peg box and the neck. If you want to add strength to that joint, wait until the glue cures. Then glue an additional thin strip of wood across the joint. You can also wait to see if it breaks, and add the strip later if it does.

Day 5 (Full block)

12. Create a shallow channel for the nut.

- a. Mark the edges of the channel with pencil
- b. Prop up the neck so that its weight does not rest on the peg box. Then carefully cut in on your marks with a coping saw. Stop sawing when the back of the blade is flush with the fret board surface.
- c. Use a chisel to “twist out” the material between your cuts.
- d. Insert the nut. Adjust as necessary.

13. Mark the fret positions.

- a. Measure (in centimeters) the distance between the front edge of the nut to the near side (or middle, if you want) of the bridge.
- b. Calculate your fret placements, based on this distance.
- c. Tape a meter stick to your fret board, so that zero cm is at the front of the nut.
- d. In pencil, mark each location on each side of the fret board. Make sure that an imaginary line between opposite fret marks would be perpendicular to the length of the neck.
- e. Using scissors, or a file, make **small** notches where each of your pencil marks meets the corner of the fret board.

14. Attach the fret “wire”

- a. Drill two ½” deep, 3/32” diameter holes
 - i. The first hole goes on the back of the neck, beneath the first fret.
 - ii. The second hole goes on the back of the neck, beneath the last fret.
- b.