

**Building demo 1:** (Using white, schedule 40 PVC) by Dr. Lenore Horner

2' section of 1/2" PVC (You should be able to find pre-cut to this length.)

2' section of 1" PVC (ditto)

1/2" PVC pipe cap (Parts wind up in the wrong bin so slip it on the pipe before you leave the store.)

1" PVC pipe cap

Put the caps on their respective pipes and drill (ordinary power drill and bits work fine) a 1/2"-diameter hole through cap and pipe. Use a bit of sandpaper to clean up any roughness on the hole but don't round over the edge - you want a sharp, smooth edge.

I have these caps glued on with the blue PVC glue, but that is probably unnecessary. If you want the lengths exact with the caps on, trim the 1" down with a hand saw. Mine are about 1/4" different due to the doming of the cap. If you can find flat caps, this probably won't be an issue.

**Using demo 1:**

Play each pipe as though it were an ordinary flute: blow across the hole. Adjust angle and how hard you blow until you get a sound. (Or get a student who plays flute to do the demo.)

The pitch difference is due to something called the end effect. When the pipe is wide, the transition to open air is less abrupt so the effective end of the pipe is later than for a narrow pipe.

**Building demo 2:**

3/4" PVC pipe cap

1" PVC pipe cap

1" by 3/4" coupler

8" of 1" PVC pipe (cut with hand saw (fine wood or a hack saw)

4" of 3/4" PVC pipe

The two sections of pipe are fit into the connector to form one piece. Store with the caps on both ends.

**Using demo 2:**

Take one cap off. Blow across that end (like blowing on a bottle) to get a sound. Put that cap back on and take the other cap off. Blow across the new open end.

These are Helmholtz resonators. They act roughly as a mass on a spring. If the neck (the top pipe) is long, then the air in it has a lot of inertia. If it is wide, the air flows in and out freely. If the volume of the body (the bottom pipe) is large, then the spring constant with which it pushes the neck air back into the neck is small.

**Building demo 3:**

Take one of your flutes from demo 1 (or maybe both so they remain identical except for diameter) and drill a 1/8"-diameter hole through both sides of the pipe 4 or 5 inches from the bottom of the pipe. Now using one of these holes to center your larger bit, drill a 3/8" hole through one side of the pipe.

**Using demo 3:**

Play as an ordinary flute. Cover one hole and leave the other open. Alternate which is covered and which open while playing continuously. It will be harder to get a sound with the small hole open - it is almost too small. The larger hole will produce a higher pitch and a slightly louder sound. The pitch is higher for the larger hole because the larger hole acts more like an end of the pipe. Both holes move the effective end of the pipe in from the actual end of the pipe, but the large hole moves the effective end almost all the way up to itself whereas so little air escapes the smaller hole that the pressure waves inside the pipe are only slightly affected and the effective end of the pipe is moved only a little.