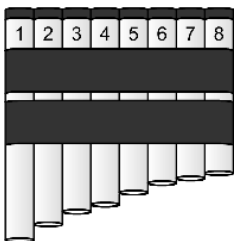


I. Preparing your materials

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material list



13 feet (4 meters) of class 200 - 3/4 inch PVC pipe

Electrical Tape

(recommend: Scotch Super 33+ Electrical Tape - 3/4 inch)

Glue

(recommend: Loctite Stik 'n Seal glue - 1 fl oz. (30 ml))

4 pair of disposable latex gloves

Duct Tape Ruler Pencil Scissors Marker Pen Newspaper

PVC pipe cutter (not a hacksaw) 1 Damp Cloth & 1 Dry Cloth



	<u>Inches</u>	<u>Centimeters</u>	
C	26 7/16	67.1	1
D	23 5/8	60.0	2
E	20 11/16	52.6	3
F	19 3/8	49.4	4
G	17 5/16	43.9	5
A	15 5/16	38.8	6
B ^b	14 3/8	36.6	minor 7
C	12 13/16	32.5	8
optional Major 7th: B natural			
B ⁿ	13 1/2	34.4	Major 7

Step 1: Use a ruler and pencil to measure and mark your PVC pipe to the eight lengths on the right, i.e., C, D, E, F, G, A, B^b, C.

Note: Our music will not use Bⁿ (B natural). However, we have also listed it here for those of you who want your instrument to play the Major 7th in the scale.

Step 2: With a PVC cutter (not a hacksaw), cut the pipe at each mark. Twist the pipe a little to start the cut. Try to make each cut as straight as possible—straight cuts will produce tubes that are “in-tune.”



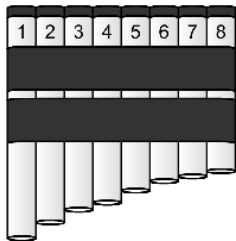
Step 3: Using a damp cloth, clean the inside and outside of your tubes—then set your tubes aside and allow to dry.



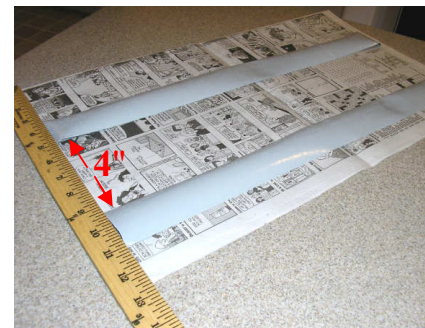
Step 4: With your scissors, cut eight pieces of electrical tape. Each section of electrical tape should be 4 inches (10 cm) in length.



II. Building your Didgeritubes



Step 5: Place two 21-inch (53 cm) strips of duct tape (sticky side up) on top of a flat piece of newspaper. Arrange the strips 4 inches (10 cm) apart—as shown on the right.



Step 6: Using a dry cloth, wipe off your tubes (inside and outside) to make sure they are thoroughly dry.



Step 7: Wrap 4-inch strips of electrical tape around the top ends. Notice that the midpoint of the tape is positioned at the top of each tube—as shown on the right.



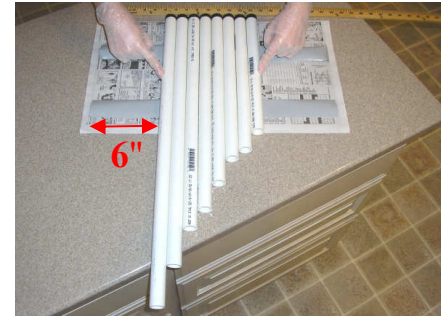
Step 8: Using your index finger, push the outside portion of the tape into the tube, so that it sticks to the inside wall. Repeat the same procedure (steps 7-8) for all remaining tubes.



Step 9: Working in a well ventilated area, and wearing latex gloves, apply a drop of glue to your index finger. Then gently apply glue inside the tube, where the tape meets the inside PVC wall. Repeat the same procedure for all remaining tubes.



Step 10: Wearing latex gloves, arrange tubes 1-8 as shown—the longest tube (number 1) is on the far left, and is placed 6 inches (15 cm) from the end of the duct tape. Position the tops of the tubes (electrical tape ends) 3 inches (7.5 cm) above the first duct tape strip. Check that the tubes make contact with the tape strips (underneath) and are tightly pressed together (side to side).



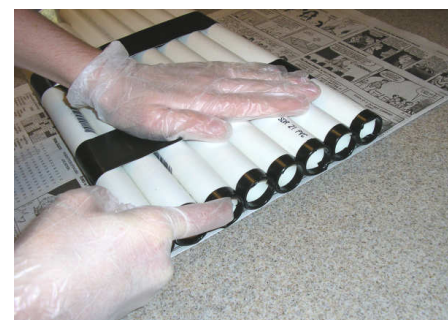
Step 11: Wearing latex gloves, apply a drop of glue between each tube—in line with the duct tape strips. Press the tubes together (side to side) to ensure that the glue makes contact with each tube.



Step 12: Wearing latex gloves, tightly wrap the duct tape around the 8-tube set. Check that all of the tubes are lined up straight and tightly pressed together.

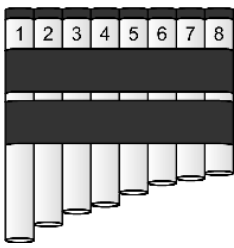


Step 13: Wearing latex gloves, recheck the electrical tape inside the tubes—it should be pressed down firmly. Allow the instrument, and the glue, to dry overnight.



Step 14: After the glue is completely dry, mark your tubes 1-8 with your marker pen. Again, tube 1 is the longest, and tube 8 is the shortest.





III. Playing your Didgeritubes

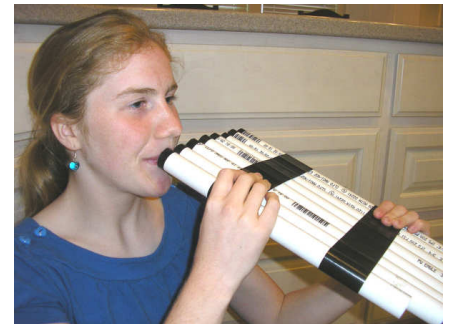
Step 15: Before you try playing the instrument, start practicing your buzz! Press your lips lightly together, and produce a buzzing sound by making your lips vibrate. Try buzzing higher, lower, louder, and softer—try buzzing your favorite song. The better you are at buzzing, the better your instrument will sound.



Step 16: After the glue is completely dry, and you've produced a nice buzzing sound with your lips, pick up your instrument. Hold your instrument so that the longest didgeritube (tube 1) is on the left, and the shortest didgeritube (tube 8) is on your right.

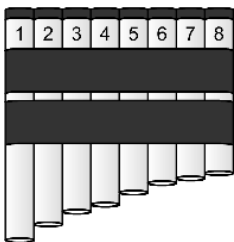


Step 17: Lightly press your lips against the one of the tubes and buzz. To produce a fuller sound, take a bigger breath and buzz more air into the tube. You will discover the right amount of air to make each tube resonate nicely.



additional playing tips

- 1) Start each note with the sound of a "T"—this is called tonguing. That is, you start each buzz by striking the tip of your tongue on the back of your top teeth. It gives each note a clean beginning and allows you to play faster melodies.
- 2) When you play the instrument, do not move your head to meet the tube you are playing. Instead, keep your head and neck steady and relaxed, and move the instrument as needed.
- 3) Look in the mirror to see if your cheeks are puffing out. Although some advanced didgeridoo players puff their cheeks to circular breathe, it's generally not recommended for beginners.
- 4) If your tone sounds airy or weak, don't press harder. Instead, practice your buzzing without the instrument (step 15) and use more air (step 17).
- 5) If your tubes are difficult to play, check to see that the electrical tape is sticking to the inside wall of the tubes (steps 8, 9, 13).



IX. 2014 Science Olympiad Addendum



sounds of music event

If you're building an instrument for the 2014 Division B Science Olympiad Competition, the tube lengths on the right will apply to "Instrument 2." We have included all 27 pitches in the "allowable scoring range" between C2 and D4. Additionally, we have highlighted the exact pitches that are required for the "C Major Scale (C3-C4)."

The tubes are tuned and calibrated to an A-440 at 72 degrees Fahrenheit. The frequencies they produce are precisely based on the "12 tone tempered scale." You will notice that each octave is divided into twelve equal semitones. Since the frequency ratio of the octave is 2, the frequency ratio s of this semitone is given by the equation: $s^{12} = 2$; $s = \sqrt[12]{2} = 1.05946$.

To obtain a fuller sound, particularly for the lower pitches, it works best if you build the entire instrument using 1-inch diameter PVC, rather than the 3/4 pipe. Either schedule 40 or class 200 will work fine—the pitch of each tube is determined by its length, not its diameter.

Intonation can vary depending on the player's breath support and buzzing technique. For the absolute best results, we recommend that you use an inexpensive tuner to fine-tune each of your tubes, like the "Korg CA-30 Chromatic Tuner" that sells for approximately \$15.

Pitch Name	Tube Length in Centimeters	Frequency in Hertz
C2	146.2	65.406
C#2	135.7	69.296
D2	125.9	73.416
Eb2	116.8	77.782
E2	108.4	82.407
F2	102.0	87.307
F#2	96.0	92.499
G2	90.3	98.000
G#3	85.1	103.830
A2	80.2	110.000
Bb2	75.6	116.540
B2	71.2	123.470
C3	67.1	130.810
C#3	63.5	138.590
D3	60.0	146.830
Eb3	56.2	155.560
E3	52.6	164.810
F3	49.4	174.610
F#3	46.6	185.000
G3	43.9	196.000
G#3	41.3	207.650
A3	38.8	220.000
Bb3	36.6	233.080
B3	34.4	246.940
C4	32.5	261.600
C#4	30.6	277.180
D4	28.9	293.670