Curiosity Guide #702
Sound Frequency
Accompanies Curious Crew, Season 7, Episode 2 (#702)

Pipe-aphone
Investigation #5

Description
Try building this amazing musical instrument!

Materials
• 4 ten-foot-long, two-inch schedule-40 PVC pipes
• 10 female-to-male 90-degree two-inch elbows
• 10 female-to-female 90-degree two-inch elbows
• Hack saw or PVC pipe cutter
• Marker
• PVC cleaner and cement
• Measuring tape
• Safety goggles
• Three-quarter-inch plywood
• 1 by 2, eight feet in length
• Jigsaw
• Drill
• Hole saw
• Hot glue
• 6 one-and one-half-inch wood screws
• 2 flip flops or shoe inserts
• Digital tuner
Procedure
1) Measure and cut the PVC pipe into the following lengths from lowest to highest, being sure to label the parts that go together.
   - C two octaves below middle C: three parts (1040 mm, 793 mm, and 508 mm)
   - F in second octave below middle C: 2 parts (1039 mm and 843 mm)
   - G in second octave below middle C: 2 parts (994 mm and 689 mm)
   - G-sharp in second octave below middle C: 2 parts (838 mm and 703 mm)
   - C one octave below middle C: 2 parts (788 mm and 404 mm)
   - C-sharp in first octave below middle C: 2 parts (740 mm and 400 mm)
   - F in first octave below middle C: 2 parts (703 mm and 200 mm)
   - G in first octave below middle C: 2 parts (603 mm and 120 mm)
   - G-sharp in first octave below middle C: 2 parts (600 mm and 123 mm)
2) Connect the sections with one female-to-male and one female-to-female elbow so that the turns create a 180-degree turn (except for the lowest C, which will have two turns using 4 elbows).
3) Strike each tube with the base of the flip flop and use the digital tuner to verify the note produced. Trim the shortest pipe section as necessary to tune the pipes.
4) Use the jigsaw and cut 3 twelve-inch diameter circles from the three-quarter-inch plywood.
5) Use the hole saw to drill a center hole and eight equidistant holes in two of the wooden circles.
6) Remove the turns off each pipe and set aside.
7) Slide the long section of the lowest C pipe through the center holes of the two wooden circles so that they are 15 inches apart.
8) Repeat with each of the other labeled pipes so that each of the tops sits 1 ½ inches above the surface of the wood.
9) Using remaining pipe parts, cut nine collars ¾ of an inch long and nine collars ¼ of an inch long.
10) Snip each collar so that it can open and slide onto the top of each pipe.
11) Hot glue the larger section below the wood around the pipe and glue the smaller one above the wood to keep the pipes in place when hit.
12) Dry fit, then cement the remaining turns in place so they don’t interfere with one another.
13) Cut the 1 by 2 into three thirty-inch sections.
14) Keeping the unit on its side, screw one of the 1 by 2 pieces to the edge of the top, middle, and third wooden circle.
15) Rotate the unit and screw in the remaining boards so that the supports are equidistant from one another.
16) Stand the unit up and strike the top pipes with the sole of the flip flop.
17) Enjoy the music you can produce!

Results

Explanation
This design was inspired by Dennis Havlena and is a percussion instrument that produces different pitches when struck. As the shoe insert hits the top of the pipe, the air inside the pipe vibrates at different frequencies that make lower or higher pitched sounds. If the pipe is shorter, there is less air to vibrate, so the short pipe vibrates more quickly and produces a higher sound. The longer the air column, the lower the pitch and the longer the wavelength.

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