Curiosity Guide #702
Sound Frequency

Accompanies Curious Crew, Season 7, Episode 2 (#702)

Bottle Carousel

Investigation #2

Description

Let's go around one more time!

Materials

- 2 identical twenty-ounce plastic bottles
- quarter-inch wood dowel, 24 inches long
- quarter-inch wood dowel, 12 inches long
- Tape
- String
- Scissors
- Computer with Audacity software
- Subwoofer
- Ring stand

Procedure

1) Blow into a bottle and listen to the frequency.
2) Using a computer and Audacity software, record the sound.
3) Copy a segment of the wavelengths and paste the sound segment multiple times back-to-back in the Audacity software.
4) Set up the ring stand. Place the long dowel in the top of the stand so that the dowel extends out and is parallel to the table.
5) Place the bottles parallel to each other on the table but facing in opposite directions and about 10 inches apart.

6) Lay the 12-inch dowel across the middle of each bottle. Tape the bottles in place to the dowel. You should have an H shape with the 12-inch dowel as the crossbar of the H.
7) Cut a length of string about 12 inches long. Attach one end of the string to the middle of the 12-inch dowel.
8) Tie or tape the other end of the string to the middle of the long dowel. This should suspend the attached bottles so that the bottles can rotate freely without interference.
9) Position the subwoofer below the bottles so that the sound travels upward.
10) Turn on the recorded sound of the bottles being blown.
11) What do you notice?

Results

Explanation

Blowing into the bottle produces a sound from the vibrating column of air in the bottle. The sound waves are traveling at a specific frequency and therefore produce a specific sound. When the speaker plays the same frequency, about 97 Hertz, the bottles begin to spin. As the sound compresses the air above the speaker, the waves enter the bottle and compress the air in the bottle. Imagine a cluster of particles in the neck of the bottle that spring into the bottle, and then bounce back. The air cluster moves beyond the starting position the other way and exits the neck of the bottle like tiny air-jet pulses. This energy moves through and propels the bottles. If the frequency is changed up or down, the frequency no longer matches the resonant frequency of the bottles and the bottles hover in place.

Think about this vibration situation. Sound is energy that comes from objects vibrating. If you were to knock on the table, that impact would cause the table particles to vibrate and the table particles would bump into the air particles all around the table, sending pulses of energized air particles, called compression waves, in every direction. When those vibrating air particles get to our ears, our brains interpret the vibration as sound. If the vibrations happen quickly, we hear a high sound, but if the vibrations happen slowly, we hear a low sound.

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WKAR