

Musical Bottles

Introduction

Have you ever wondered how a recorder or flute is able to make music? Blowing on a wind instrument causes the air inside to vibrate and produce a standing wave. The listener then hears a musical note coming from the instrument! We will demonstrate how this works by making and tuning our own bottle instruments.

Materials

Plastic bottles

Water

Methods

1. Take an empty bottle and fill it partially with water.
2. Blow over the top of the bottle so that a clear note resonates within the bottle.
3. Tune your instrument by changing the water level to match your desired pitch.
4. As a group, try to play a tune.

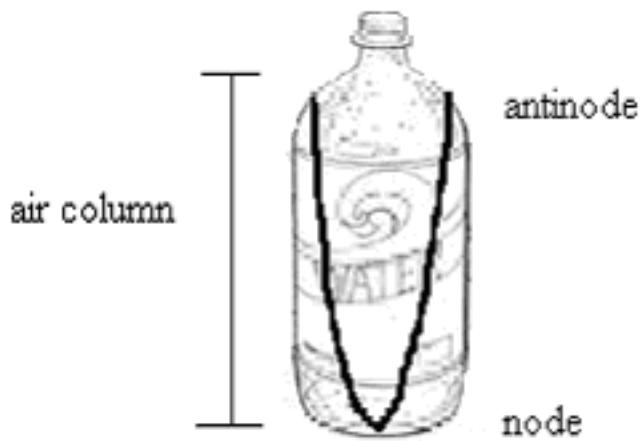
Discussion Questions

The bottle can be thought of as a pipe that is open at one end and closed at the other end.

1. Why does blowing on the bottle cause a note to be played?
2. What kind of wave are sound waves (transverse or longitudinal)?

So the part of the instrument that allows you to play different notes is the length of the **air column**, or the length from the surface of the water to the top of the bottle.

If you have no water in the bottle, a wave such as shown below will be vibrating in the air column, with a node at one end and an antinode at the other end:



3. Draw what happens to the sound wave as you increase the amount of water in the bottle:



4. What happens to the **wavelength (λ)** as water level rises?

5. What happens to **frequency (f)** as water level rises (keep in mind that $c = \lambda f$ where c, the speed of sound, is a constant)?

6. What happens to **pitch** as water level rises?

Assessment questions

1. Why do piccolos sound so much shriller than flutes?

2. In wind instruments, blowing harder may produce a different note that is higher in frequency. Why?