

Stationary waves in an air column

Demonstration

This experiment demonstrates vividly how sound waves make air vibrate in a tube.

Apparatus and materials

Loudspeaker

Signal generator

Polystyrene beads, small

Filter funnel

Tube, transparent plastic or glass (1.0m to 1.5m long)

Rubber bung, or similar, to seal one end of tube

Health & Safety and Technical notes

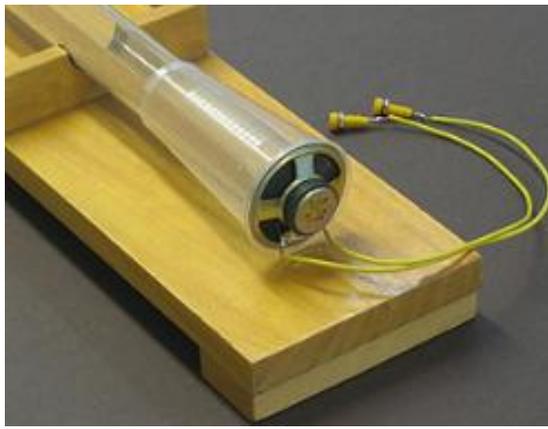
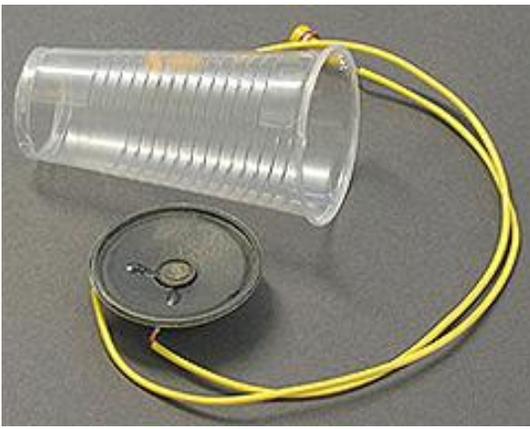
[Read our standard health & safety guidance](#) ^[1]

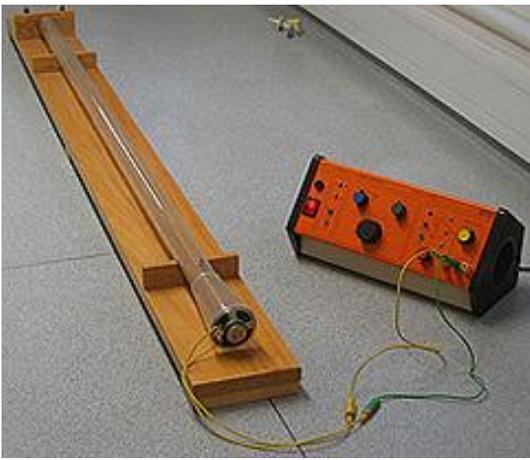
Place a thin layer of polystyrene beads along the length of the tube.

Alternatively, you could use lycopodium powder or cork dust. These materials are best inserted by first sprinkling them along a metre rule, placing the rule inside the tube and then inverting it.

Tape the loudspeaker in place. If the loudspeaker and tube have different diameters, join them with a paper cone or plastic cup.

A [video](#) ^[2] showing how to use a signal generator is available at the National STEM Centre eLibrary.





Photographs courtesy of Mike Vetterlein

Procedure

a Switch on the signal generator. Vary the sound coming out of the loudspeaker, changing its amplitude or frequency, or both. Ask students to observe the effect that each of these changes have on the vibrations of the beads.

b At some particular frequencies, a standing wave pattern will be formed, with the beads settling into heaps (piles) at certain positions along the tube.

Teaching notes

At the simplest level, this experiment demonstrates that sounds from the loudspeaker produce vibrations in air.

At more advanced level, you could measure the average distance between adjacent nodes (where the beads settle). This will be half a wavelength. You could then explore the relationship between frequency and wavelength, for frequencies that produce a standing wave pattern (they should be inversely proportional).

Using wave speed = frequency \times wavelength you could also go on to make an estimate of the speed of sound in air at the temperature of the room.

A version of this experiment, using polystyrene beads, was shown by Pascal Daman on the Luxemburg stand at *Physics on Stage 3* in November 2003.

This experiment was safety-checked in February 2006

Related experiments

Standing waves along trollyes [4]

Weblinks

Physics on stage [5]

Source URL: <http://www.nuffieldfoundation.org/practical-physics/stationary-waves-air-column>

Links:

[1] <http://www.nuffieldfoundation.org/node/1634/>

[2] <http://www.nationalstemcentre.org.uk/elibrary/resource/4104/signal-generator>

[3] <http://www.nuffieldfoundation.org/node/2046>

[4] <http://www.nuffieldfoundation.org/node/2044>

[5] <http://www.eso.org/public/outreach/eduoff/pos.html>