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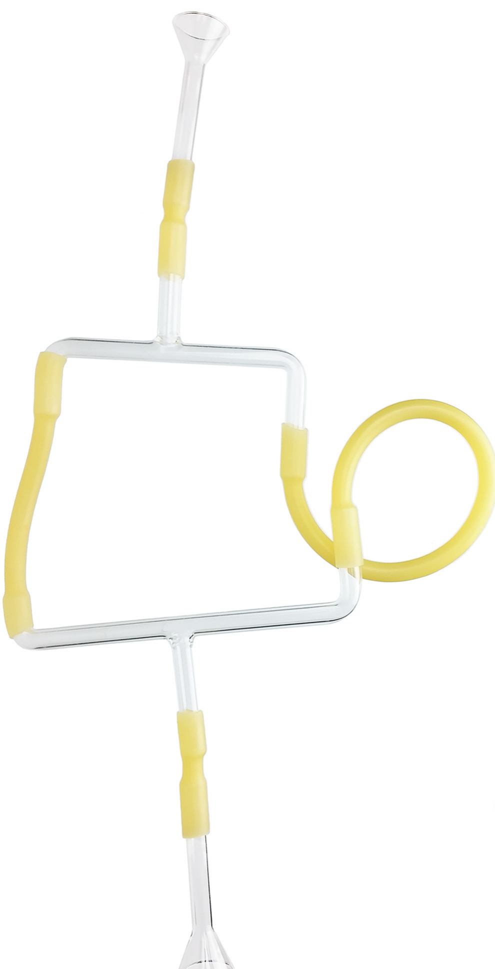
Quincke's Interference Tube
#904

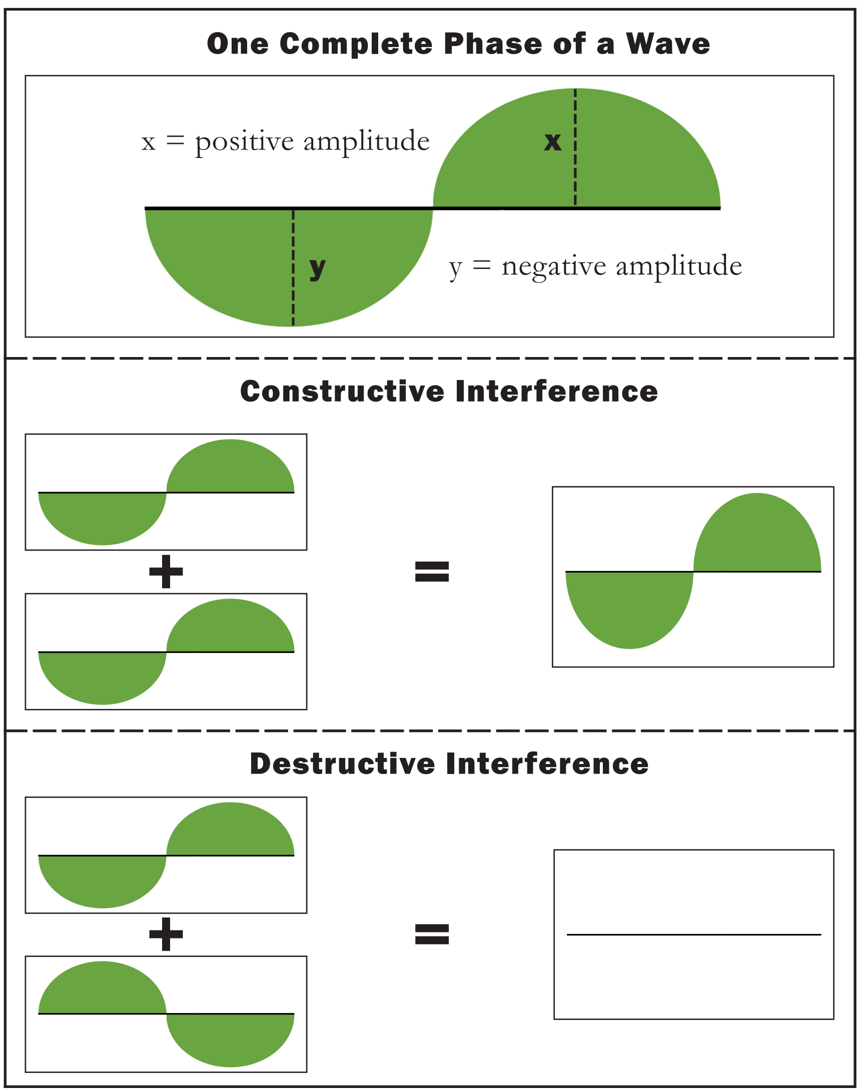
Warning:

- Not a toy; use only in a laboratory or educational setting.
- Contains latex.
- California Proposition 65 Warning: This product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.



Introduction

Invented by German physicist Georg Hermann Quincke, the Interference Tube is used to demonstrate the principle of interference in relationship to sound waves. When two sound waves (for the purposes of this experiment) interact with each other, they can either add to their **amplitudes**, or subtract from their **amplitudes**, depending on whether or not they are **in phase** with each other.



How to Use

1. Set up your apparatus like it is on the previous page. The U-shaped tubes joined by the latex tubing will create two paths for sound to travel through. One path needs to be exactly one half-wavelength longer than the other. There is information in the following section on how to best approximate the length of tubing that you will need to cut to make the paths differ from each other by one half-wavelength.
   (Note: Use a little bit of water to make attaching the latex tubing easier.**)**
   (Note: There is no sound generator included with this apparatus. We recommend using a tuning fork or any of the multiple tuning apps available for your phone. The most helpful thing to have is a sound generator that puts out a constant, known frequency. This apparatus is supplied with enough tubing to observe destructive interference with frequencies approximately 200 Hz or greater.**)**

2. Hold one funnel up to your ear, and the other in front of your sound generator.

3. Create a sound with your generator beside the funnel. Experiment with pinching closed the longer latex tube. If you set up the apparatus perfectly in step 1, you should hear noise only when pinching the tube. This is **destructive interference**, which occurs when two wavelengths are out of phase when they reach your ear. There are many variables that make perfect destructive interference difficult to achieve. Even if you still hear something without pinching the tube, you should still be able to observe partial destructive interference.
   (Note: You're only one person. Ask a partner to hold something or pinch the tube for you if you need it.**)**

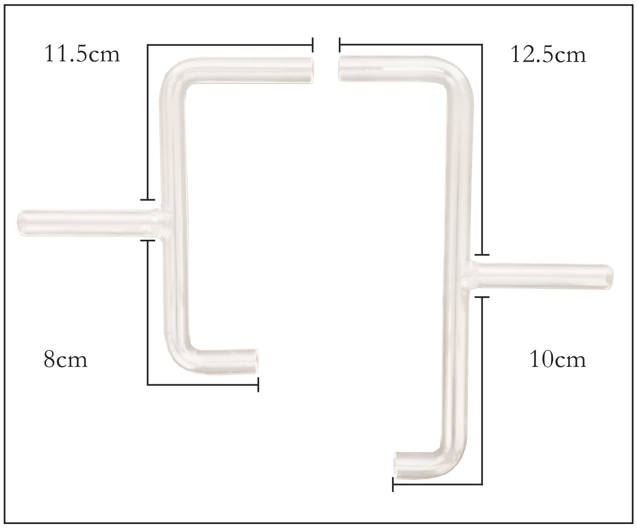
Setting Up Your Apparatus

Perfect deconstructive interference can be tricky to observe. The most difficult part of this experiment is getting the length of the two paths in the U-tubes exactly right. You will need to calculate the length of a wave at a given frequency and cut your tube to create two paths that differ in length by exactly half the length of your wave. To find out your wavelength, divide the speed of sound by the frequency of your noise. To find the distance that your paths need to differ by, divide the wavelength in half.

The table to the right displays approximations of the speed of sound in dry air at various temperatures. Use the speed that corresponds best to the temperature of the room you're in. A more precise speed of sound measurement can get you closer to perfect deconstructive interference, though finding that is a bit more involved than what can be fit on this sheet. There are resources elsewhere online to calculate the exact speed of sound for your specific conditions.

Temperature (Fahrenheit)	Speed of Sound (cm/s)
32°	33,127
65°	34,220
70°	34,383
75°	34,545

The labeled image to the right displays the lengths of each arm of each U-tube. Consider these lengths alongside the wavelength you found earlier when cutting your tubing.



$$\frac{(c/f)}{2} = x$$

- **c = speed of sound (cm/s)**
- **f = frequency (Hz)**
- **x = half-wavelength (cm)**