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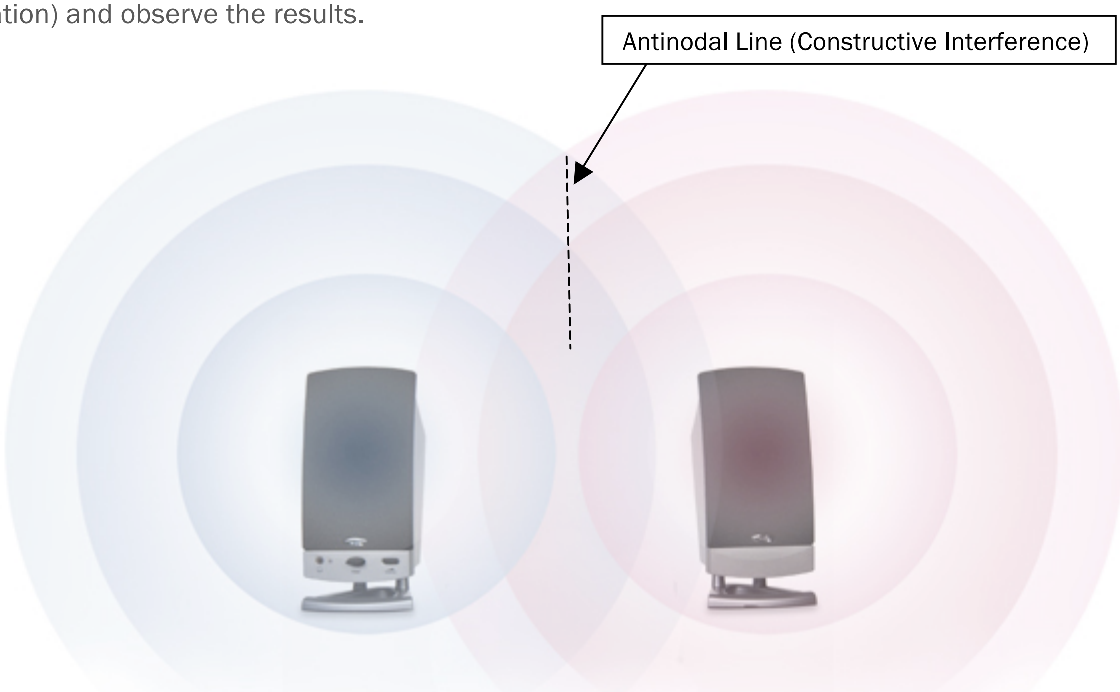
Sound Wave Interference Kit

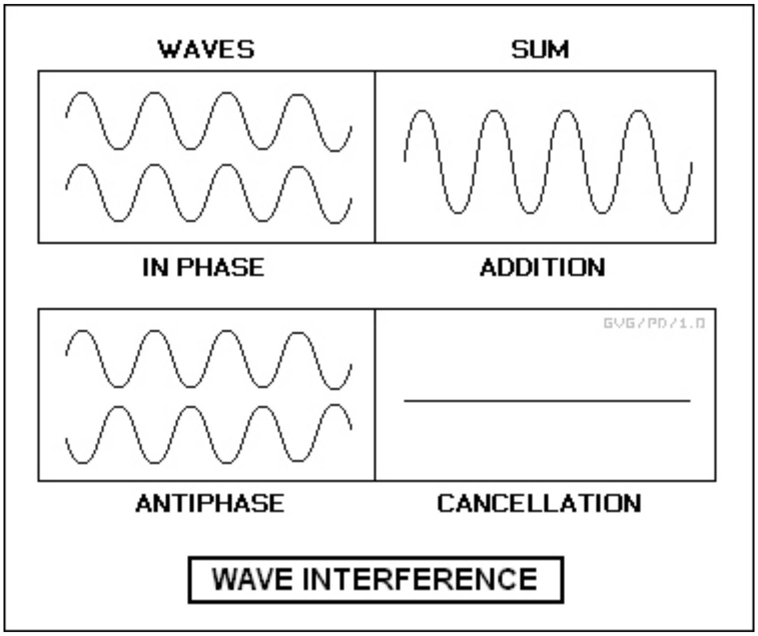
P7-7600

BACKGROUND:

Two waves, when traveling through the same medium, will superimpose upon one another, causing interference. In the case of sound, the two sounds will combine to form a single sound. This lab asks students to combine the sounds from two speakers (from which each produces a simple sine wave vibration) and observe the results.



The image above shows the arrangement for this demonstration. Two speakers are emitting exactly the same tone. The *wave crests* are shown in colored shading. As the waves travel away from each of the speakers, they combine with the waves from the other speakers. Where two wave crests (maxima) meet, *constructive interference* occurs, and the resulting sound is loud. This point is called an anti*node*. Where a wave crest (maximum) meets a wave trough (minimum), *destructive interference* occurs. The sound is cancelled, and the observer hears nothing. This is a *node*.



SETUP AND EXPERIMENTS:

1. Connect the speakers to the “Sine Out” jack on the signal generator using the included 1/8" Stereo to 1/4" mono adapter.

2. Plug in the power supplies for the speakers and signal generator. The signal generator power adapter connects into the “DC IN” jack.

3. Arrange the speakers so that they face the class, at least one meter apart.

4. Turn the signal generator on and adjust the frequency and Sine Level (amplitude) to the tone of your choice. (Lower-frequency tones will produce nodes that are farther apart, which is preferable for the first observations.) Make sure that the Square wave dial is at zero. The “Pad” button should be in the “Normal” position.

5. Invite students to move side-to-side through the sound. Plugging one ear will help them observe the nodes and antinodes, since the points may be separated by only the width of a human head.

6. Invite one student at a time to observe the space directly between the speakers. They will find that an antinode occurs halfway between the speakers. Depending on the frequency and the separation of the speakers, they may observe several nodes and antinodes along this line.

QUANTITATIVE EXPERIMENT – FIND THE WAVELENGTH:

You can use Young’s Double Slit formula (derived for use with light in the study of quantum mechanics) to calculate the wavelength using measurements taken during this demonstration.

1. Set up the apparatus as usual. Please note that since sound waves readily reflect off of hard surfaces, this experiment may not work in an ordinary classroom full of tables and chairs. For accurate results, set up outdoors on grass, in an acoustics lab, or in a carpeted auditorium.

$$\lambda = \frac{xd}{nL}$$

λ = wavelength of sound

x = distance from central Antinode (m)

d = distance between the speakers (m)

n = the order of the Antinode (see explanation below)

L = length from the speakers to the observer (perpendicular to speaker line)

2. Measure the distance between the centers of the speakers. This is d.
3. Locate the central Antinode at a point in front of the speakers. Measure the perpendicular distance from the observer's ear to the speaker line. This is L. Place a meter stick on the floor, parallel to the speaker line, with zero at the node point.
4. Move to one side, along the meter stick, and locate the next Antinode. (Here, n=1. The first Antinode from the center.)Mark the distance from the center Antinode to the first Antinode. This is x.
5. Calculate λ, the wavelength.