

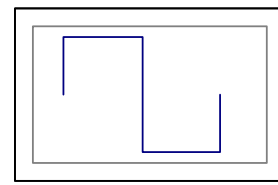
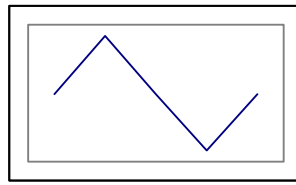
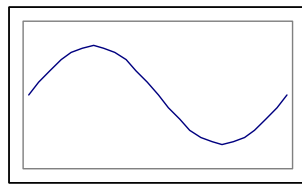
# Wave Generators and Speakers

## Equipment

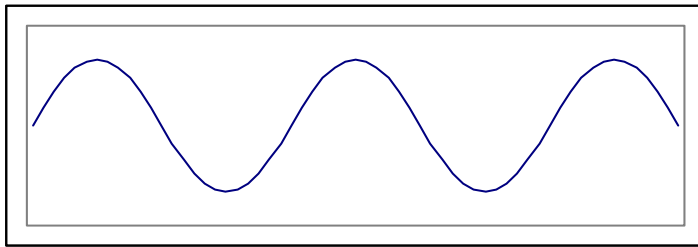
- Wave Generator (2)
- Speaker (2)
- Patch Cords (connecting wires)
- LabPro (1)
- Ti-83 Calculator (1)
- Microphone probe (1)

## Warm-up Activity: Wave Properties

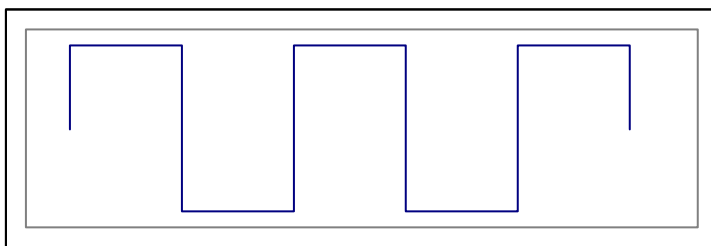
- A. Identify the shapes and name the following three common types of waves produced by a wave generator – square wave, sine wave, and saw-tooth wave.



- B. The highest point on a wave is called a *crest*, the lowest point a *trough*, and the height from the median to a crest or a trough is called the *amplitude* of the wave. One complete wave is one back and forth motion (up and down as seen on the waves) and the measure of horizontal distance from left to right for one wave is called a *wavelength*.
- C. *Frequency* is a count of the number of waves produced in a given time (1sec). Find the frequency of the waves below and write the answer in the boxes.



In one second



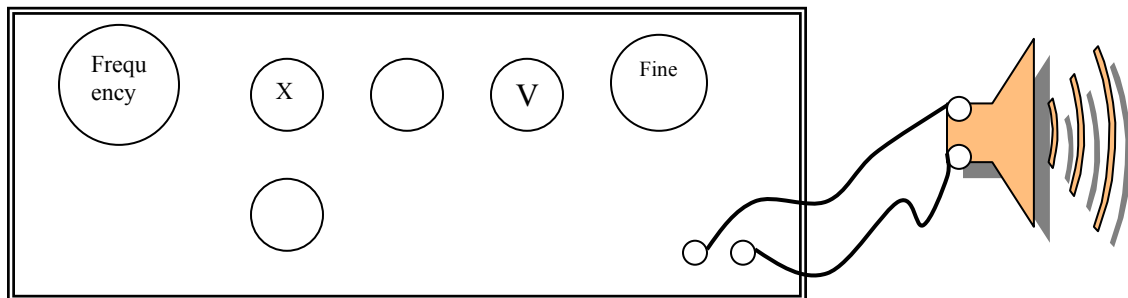
In ten seconds

D. Compare and contrast the two waves in section C and tabulate your results in the table below. Use a ruler to measure the amplitudes and wavelengths.

	Number of Crests	Number of Troughs	Number of Waves	Amplitude in cm	Wavelength in cm	Frequency of the wave = Number of waves / sec
Sine Wave						
Square Wave						

### Audible Range


- A. Connect the output of a wave generator to a speaker using two patch cords. With all knobs set at minimum, turn the wave generator power on and choose sine wave settings. You may also have to set the voltage V at 1-10 volt range. At this point do you hear anything at all, Explain why?



- B. Observe (hearing) the sound as you crank up the frequency of the wave (you may also have to use the multiplication factor X to increase the frequency). Note the lowest and the highest frequencies that can be heard? This range of frequencies is known as the audible range of frequency. Explain why the sound below and above this range was not heard. Audible range for normal hearing is 20 Hertz – 20,000 Hertz. Was sound actually being produced beyond this range? Explain.
- C. Sound frequencies below audible range are known as *Infrasonic* and above are called *Ultrasonic*. How do the wavelengths of infrasonic and ultrasonic waves compare to their frequencies.

## Reflection and Refraction of a Sound Wave

Obtain a calculator and LabPro – Connect a Microphone Sensor – Follow directions as provided in other PhysVan Activity worksheets for setup. Point the microphone at the speaker to take measurements.

Set the frequency at 5000 Hz – Point the Microphone at the speaker – On the main screen of the LabPro select 2 for START to collect data. After you see the Graph hit ENTER, press 3 for Graph and hit ENTER again. Press 2 for selecting RANGE, use  and ENTER to select a suitable range of the graph for measurements.

Measure the time taken for one complete wave and calculate its frequency.

- A. Point the speaker at a smooth surface at a  $45^\circ$  angle of incidence. Hold the microphone also at  $45^\circ$  angle to this surface so that speaker and the microphone are at right angles to each other. When you are ready to collect the data again select 2 for START. It is advisable to hold a barrier between the speaker and the microphone.

Predict if any waves would be detected by the microphone.

Were any waves detected by the microphone, was it consistent with your prediction, Explain?

- B. Hold a balloon filled with carbon dioxide in between the speaker and the microphone and collect data again. The microphone should be stemmed on the balloon but the speaker should be about a foot away from the balloon.

Explore the area near the balloon on the side away from the speaker. Did the wave pass through the balloon, explain.

Bouncing of waves from a surface is called *Reflection* and when waves pass from one medium to another medium it is called *Refraction*.

## Interference and Diffraction of Sound Waves. (Optional)

Other properties of waves such as interference and diffraction can also be observed with this setup.

QADRI