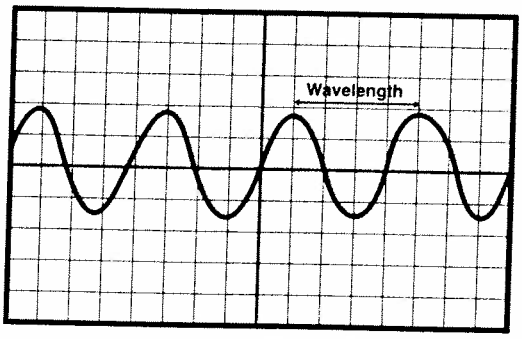
SCOPING OUT SOUND

You already know that sound is caused by vibrations. No one can see these vibrations. But scientists do have a special machine that creates an image of sound. This machine is called an *oscilloscope.* Using complex electronics, the oscilloscope makes a picture of sound.

The oscilloscope has a TV-like screen. Sound vibrations are shown on the oscilloscope screen as *sound waves.* They look like wavy lines. However, these lines are not what real sound actually looks like. The wavy lines are just electronic images of sound.

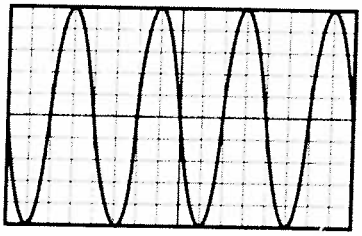
MEASURING UP

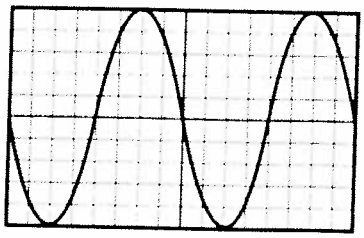
The oscilloscope screen has a line running across the middle. Each sound wave on an oscilloscope screen has a series of high points above the line. The wave also has low points below the line. The distance from one highest point to the next is the sound's *wavelength.*



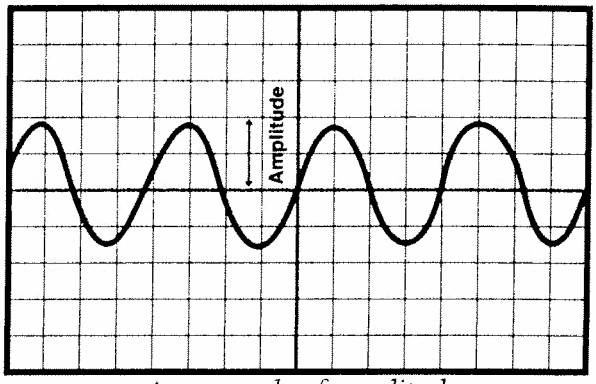
An example of wavelength

An oscilloscope can measure the pitch of a sound. Scientists count how many complete waves pass a certain point in 1 second. The number is the sound's frequency. The fewer the number of waves that pass, the lower the frequency. A low-pitched sound such as the bark of a big dog might have 500 wavelengths passing in 1 second. A high-pitched sound such as a note from a singing bird might have 20,000 wavelengths passing in 1 second.


High-frequency waves

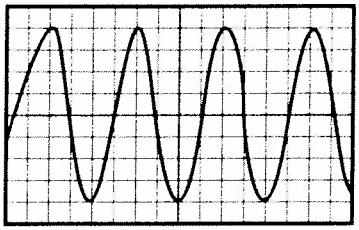

Low-frequency waves

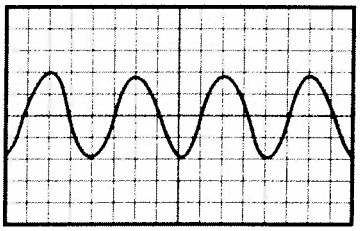
Frequency is just one part of a sound wave. The height of the wave is also important. This height is called *amplitude,* and it relates to the volume of sound. A loud sound has a wave with a high amplitude. A softer sound of the same pitch has a shorter wave. An oscilloscope also shows the amplitude of a wave.



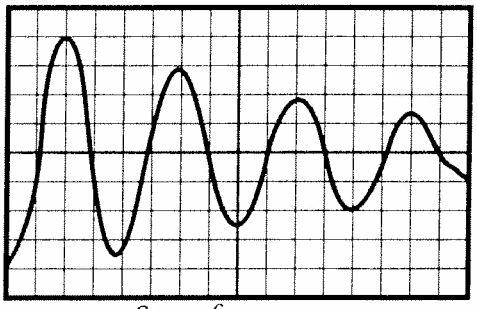
An example of amplitude

Two sound waves could have the same wavelength, or frequency, but have different amplitudes. Or the waves might have the same amplitude but different frequencies.

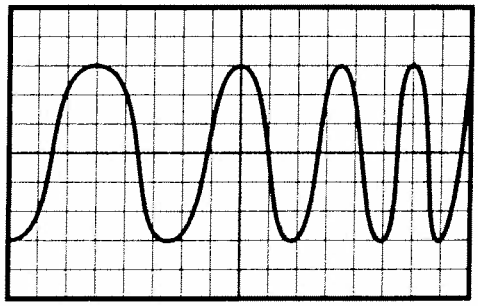

High amplitude


Low amplitude

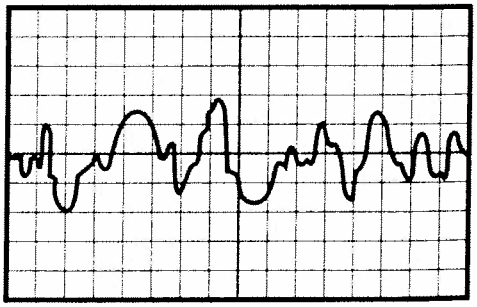
A sound source might change the frequency or amplitude of its vibrations. The oscilloscope shows those changes. A musician could bang one key on a piano. The sound wave for that musical note would have a high amplitude. But gradually the note would grow softer. On an oscilloscope, the wave for the note would become shorter, but the frequency would be the same.


Same frequency, decreasing amplitude

In a similar way, a tone's volume could stay the same, but its pitch might change. An oscilloscope would show this with a wave that had the same amplitude, but a higher or lower frequency.


Increasing frequency, same amplitude

When you hear noise, both the volume and the pitch of sound change constantly. The picture to the right shows what noise looks like on the oscilloscope.


Noise