**The Basics of Sound Waves**

[Sound waves](https://thescienceclassroom.wikispaces.com/Sound%2Bwaves) are a series of longitudinal or compression waves that move through air or other materials. However, sound doesn't travel through vacuums. Sound waves are created by the vibration of an object, like the strings on a violin. Sound is about 4 times faster in liquids than in solids. It is also faster in higher [temperatures](https://thescienceclassroom.wikispaces.com/temperatures) than in lower temperatures. However, temperature and structure aren't the only things that effect the [speed of sound](https://thescienceclassroom.wikispaces.com/speed%2Bof%2Bsound). The substance of a medium that sound goes through is the main cause for it to slow down/get faster. For example, if you set up two drums,one of them facing a steel wall and the other facing nothing but [air](https://thescienceclassroom.wikispaces.com/air), the sound of the drum facing the steel wall will be MUCH faster than the one facing nothing. The temperature and structure only have minor effects on the speed of sound.

**‍History of Sound Waves**

[Leonardo Da Vinci](https://thescienceclassroom.wikispaces.com/Leonardo%2BDa%2BVinci) was the first person to discover that sound traveled in waves back in 1500. Over a hundred years later, Martin Mersenne was the first to measure the speed of sound in air. Over the next 200 years or so many other scientists will contribute to the discovery of sound and further their ideas on the topic. The following is a short list of the scientists who, during the 1600s, discovered different aspects of sound as we understand it today:

* 1638 - Galileo explains the relation of pitch to frequency, consonance, and dissonance.
* 1650 - [Kircher](https://thescienceclassroom.wikispaces.com/Kircher) studies the acoustical horn and invents the loud-speaking trumpet.
* 1654 - [von Guericke](https://thescienceclassroom.wikispaces.com/von%2BGuericke) and [Boyle & Hooke](https://thescienceclassroom.wikispaces.com/Boyle%2B%26%2BHooke) discover that sound does not multiply in a vacuum.
* 1686 - [Newton](https://thescienceclassroom.wikispaces.com/Newton) computes the speed of sound in a gas.

**‍The Basics of Sound Frequencies**

[Sound frequencies](https://thescienceclassroom.wikispaces.com/Sound%2Bfrequencies) refer to how often the particles of a medium vibrate when a wave passes through a medium. Also known as [*pitch*](https://thescienceclassroom.wikispaces.com/pitch), sound frequencies are measured as the number of back-and-forth vibrations for a particle of the medium per unit of time. The higher the frequencies are, the smaller the wavelength of the wave will be. The smaller the [wavelength](https://thescienceclassroom.wikispaces.com/wavelength), the smaller the period (the distance between each [amplitude](https://thescienceclassroom.wikispaces.com/amplitude) of a wave). The most commonly used unit for frequency is a [Hertz](https://thescienceclassroom.wikispaces.com/Hertz) (Hz). 1 Hertz is equal to 1 vibration per second. So for example, if a particle of air undergoes 2000 vibrations in 2 seconds, then the frequency of the wave is 1000 vibrations, or 1000 Hz. When the sound frequency gets higher than 20,000 Hz, it surpassses the audible range for the human ear. The sound waves that are produced at the +20,000 Hz range are called [*ultrasound*](https://thescienceclassroom.wikispaces.com/ultrasound). Ultrasound is extremely helpful, especially in the medical field. It can be used to examine different parts of the human body, help physicians evaluate symptoms such as, pain swelling, and infection, and more. Unlike X-rays, ultrasound doesn't involve exposure to radiation.

**‍History of Sound Frequencies**

One of the reasons why we know so much about sound frequencies is because of [Galileo](https://thescienceclassroom.wikispaces.com/Galileo). Although [Christian Doppler](https://thescienceclassroom.wikispaces.com/Christian%2BDoppler) was the first to discover sound frequencies and what they are, Galilieo was the one that showed the world how to create a pitch. He did this by scraping a chisel across a brass plate, producing a screech. Galileo then explained that the spacing of the grooves on the plate is what makes the pitch higher or lower.

**‍Our Experiment**

Our experiment is about the structure of a glass cup and how you can break it with sound waves. We need a piece of crystal glass to break. Crystal resonates all at one particular [harmonic frequency](https://thescienceclassroom.wikispaces.com/harmonic%2Bfrequency). We need a type of glass that, when you tap on the glass, it makes loud sounds. We need to make a sound frequency that has the same frequency as the crystal glass. We need a high amplitude to do this. You need a microphone and an amp to put it in a closed area so the sound waves are louder. We are going to video tape the experiment as it happens. To start off the experiment we are going to get a glass cup that is delicate and not very strong. We have to learn about amplifiers and how there sound waves work. We are going to go off of the sound knob on the amplifier. The sound knob on the amplifier goes on a scale of one to ten. We will have five trials, starting with the knob on number five and go to ten. We are going to strum the guitar five times and count the seconds that it takes for the structure of the glass to break. We will also listen for the hum of the glass or the sound it makes and how long the sound goes. After we get our results, we are going to post the results of the experiment on the wiki, and also post the video of the experiment on the wiki. We will also post videos that give a visual representation of how sound looks and the mechanics behind it all.

**‍Vibrations**

[Vibrations](https://thescienceclassroom.wikispaces.com/Vibrations) is a big part of the experiment. Sound puts off vibrations that affect the glass. The vibrations is formed from sound waves. Vibration is the study of noise and vibration characteristics of vehicles, particularly cars and trucks. Example of vibrations would be when your riding around in your car and listening to your stereo and the base from the car creates vibrations and rattles the car. The example from our experiment would be when you sing into the microphone you put off frequencies and vibrations that hit the glass and make it bust.Another example for natural vibration would be if there was a earthquake the tectonic plates in earths core would make vibrations that break and shatter anything in its path. For are experiment an [earthquake](https://thescienceclassroom.wikispaces.com/earthquake) is a good example. We have to create something similar to an earthquake to shatter the glass.

**‍Amplitude**

[Amplitude](https://thescienceclassroom.wikispaces.com/Amplitude) is the magnitude of change in a variable. Amplitude is due to the pressure in the air. An amplifier is used to make the [human voice](https://thescienceclassroom.wikispaces.com/human%2Bvoice) sound louder or clearer. You can amplify something to make it sound the way you want it to sound.Efficiency is a measure of how much power the amp put out. Example of an amplifier would be when your at a concert and you can hear the person singing. The reason you can hear them singing is because the microphone is plugged into the amplifier to make the singer voice sound louder.

**‍Resonant Frequency**

[Resonant frequency](https://thescienceclassroom.wikispaces.com/Resonant%2Bfrequency) is a big part in what makes the structure of glass break.Resonance was noticed by Galileo in 1602.Resonance deals with the amplitude of an object.Resonance occurs with all kinds of different vibrations.There are all kinds of resonance there is mechanical resonance, acoustic resonance, electric resonance, nuclear magnetic resonance,and electron spin resonance. A good example of resonant frequency would be with a swing set. The swing is like a pendulum and the more you push the swing the higher and higher the amplitude gets.Resonance occurs alot with nature and many man made machines.Most objects have a different frequency that objects resonant at.