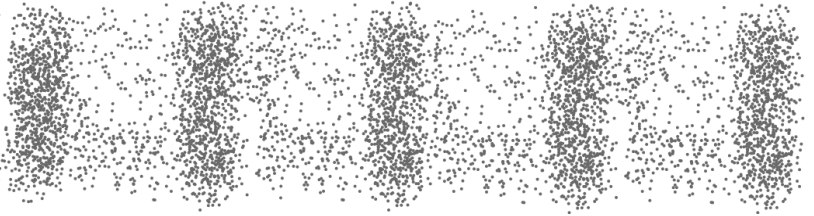
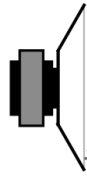


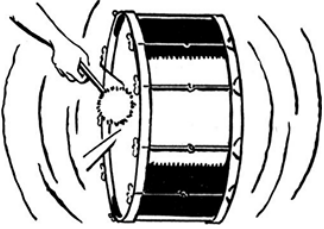


## SoundScience



Feel Sound? See sound? Sound weird? Here's what (probably) happened at your assembly:

Each of our senses are really good at observing specific things. Sound is what we hear when something makes our ears **vibrate** back and forth. Usually those vibrations are too small and fast to see or feel, but our ears notice!



Speakers, instruments, and anything that makes sound **pushes and pulls on stuff**; usually it's air. Those air particles get squished together, then spring apart and bump into other air particles, which bump into other air particles, which happens over and over. Eventually some nearby air bumps into your ear, and you hear it.

Slow waves sounded a lot like a slow car engine, vibrating back and forth. But what happens when an engine speeds up? It starts to sound like a note, and the note gets...higher! Racecars and motorcycle engines move so fast that they sound almost like musical instruments! When vibrations go back and forth more often, it sounds like a higher note, or a **higher pitch**. Vibrate less often, and the note sounds lower, or has a **lower pitch**.



If something happens frequently, it means it happens often. How often? That's **frequency**. You eat breakfast once each day, so your frequency is 1 per day. Reading this while sitting still, you're probably breathing around 15 times each minute; get up and exercise, and you might start breathing 30 times per minute or more! You changed your frequency. Our ears notice sounds when things vibrate between 20 and 20,000 times per second! That's frequent!

Instead of writing "times per second" we usually write Hz, which stands for **Hertz** and sounds just like "hurts." So 20 times per second is 20Hz.

To see what our ears were hearing, we made a speaker vibrate slowly, so that we could see the vibrations. Even when the speaker moved too fast for our eyes to see, those vibrations made ping pong balls fly.



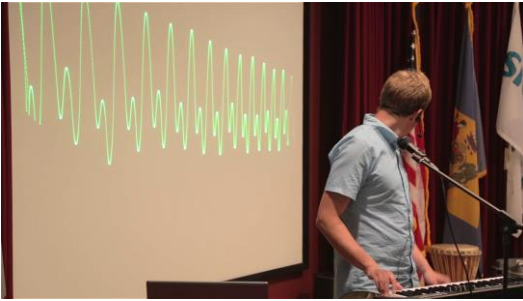
Tiny vibrations worked, but big vibrations shot those ping pong balls higher into the air! Tiny vibrations sound quiet to us. Move more air, and sounds get louder! That's how sound **volume** works. The vibrations don't get faster, they get bigger! (The word for wave "bigness" is **amplitude**.) For your assembly, we used big speakers to vibrate more air. Our sounds were so loud that everyone at the assembly could hear.

Learn more about sound  
(and download this sheet) at:  
[wondergy.com/sound](http://wondergy.com/sound)

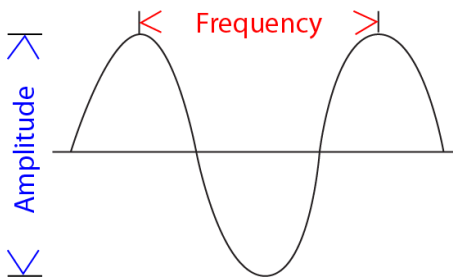




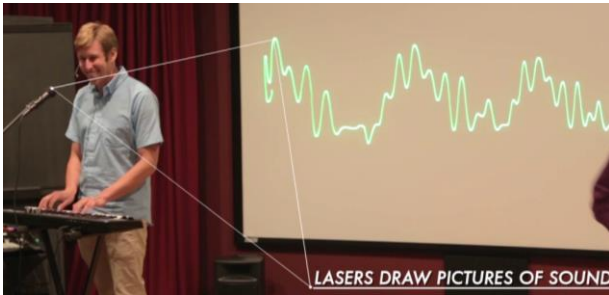
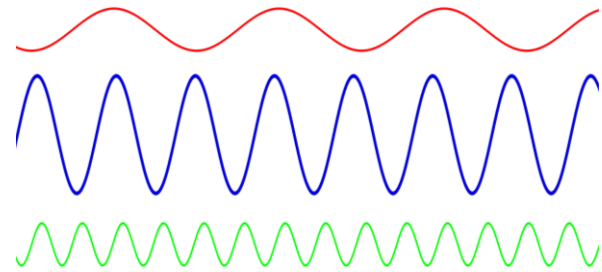
# SoundScience



To really see a picture of **waves**, a microphone can pick them up and turn those pushes and pulls into up-down movement of a laser beam. To spread the vibrations out on the wall, we made the dot move side-to-side. This really is a laser show made of sound! Another word for waves is **oscillations**, and a scope is something you use to see, therefore a tool for *seeing waves* is called an oscilloscope.



Now that we can see quick vibrations, we can see what makes *sounds sound* the way they *sound*. Louder sounds made bigger waves. Higher pitches made waves that packed together tightly, fitting more waves into the same amount of time.



If different sounds mix together, they can add up into a more complicated vibration. In fact, most sounds that we hear are made up of many different sounds, even if they sound simple or come from a single instrument. When we listen to music with only two speakers, we can hear many instruments at the same time.



Sometimes objects can block parts of waves. For example, when a car passes with its windows closed, the music they're playing inside sounds different. The windows block the quick vibrations (high frequencies) while letting slow vibrations through.

Our voice starts with many different sounds. We move our mouth like a car window opening and closing to allow only some sounds out. That's how we make the sounds that make up our words.

Explore more science  
(and download this sheet) at:  
[WONDERGY.COM/SOUND](http://WONDERGY.COM/SOUND)

