FEEL THE NOISE (G3-6)

Students will explore the physics of sound by testing and creating their own simple instruments. At the end, each student will build an ear harp that they can take home. The Works Museum's educators will provide a prescribed set of materials to use during building and a basic outline for construction with details left to the individual student to decide. Educators will also instruct and monitor students for safe tool use. See p. 3 for standards this workshop supports.

SCIENCE CONCEPTS

Sound travels in waves. We hear sound because these waves vibrate air or wood or water as they travel until the sound waves reach our bodies and vibrate delicate organs inside our ears. Sound can change in pitch (the difference between a large dog's deep bark or a terrier's high-pitched yip), or in volume (how loud it is).
Waves that are bunched up tightly and vibrate very rapidly have a higher pitch.

1. Thinner or shorter materials (think the narrowest string on a violin or a tiny service bell) will have higher pitches.
2. We can also increase the pitch of a violin or guitar string by stretching it more tightly.

- Waves that are spaced out and vibrate more slowly have a lower pitch.
  1. Thicker or longer materials (think of a cello's thick strings or a giant church bell) will have lower pitches.
  2. We can also decrease the pitch of a violin or guitar string by loosening it.

Volume describes how loud a sound is.

- Waves that are taller are louder.
- We can usually change the volume of a sound by increasing how hard we hit or blow through our instrument.

Making instruments is about the art of understanding music and sound, but also about the science, engineering, and hands-on craft of understanding how wood, metal, and strings vibrate and work together. All of these aspects come together in a successful musical instrument.

BEFORE YOU VISIT

How do we hear?	Sound travels in waves from a source, such as an instrument, through the air to our ears. These waves vibrate the instrument, the air, and our ear, and this is how sound travels.
Can we hear through air? Water? Through walls? How?	Sound waves are still vibrating! They create waves in air, in water, and even vibrate walls, if they are thin enough. If sound is present, something is vibrating.
What are different kinds of instruments? How do they each make sound?	Most student's answers will fall under the traditional categories of stringed instruments, percussion (things you hit), and brass/woodwind (things you blow into).
What is the difference between music and noise?	Music is a type of noise, and sometimes people disagree about what kinds of sounds are truly music. But generally music has some kind of pattern to it that at least some people find enjoyable.

AFTER YOU VISIT

Questions

- Why do we make instruments out of hard things such as wood and metal? What would happen if we made them out of soft materials such as fabric? (Answer: soft materials are good shock absorbers because they don't vibrate at all, so they are terrible for sound-making.)

Activities

Change your harp around!

- Without removing the nails, have students create new sounds with their ear harps.
    3. Students might change the shape of how their rubber bands are strung on the nails.
    4. Students might also wind their rubber bands more or less tightly, or swap a thick rubber band for a thinner one, or vice versa.

Play a song!

- "Merrily We Roll Along" and "Hot Cross Buns" both have only three notes. Can students play them on their ear harps?
- Have students try making up their own song.

CAREERS THAT USE ENGINEERING

Carpenter: For people who like working with their hands, carpentry is a field with many different kinds of work. Carpenters might be responsible for creating and building furniture, like cabinets and tables. Or they might do the physical work of building a house.

Instrument making and repair: These people are usually masters of woodworking or craftsmanship, since the tiniest details affect how the instrument sounds. Many instruments are still made by hand, so these craftspeople use many manual skills. Creating instruments involves design as well as construction by hand.

Audio engineer: These people are responsible for making sure that sounds in a concert or recording behave correctly. Balancing different instruments, recordings, and speakers is a challenge, and often one that engineers must manage on short time demands. They must understand how sound moves, bounces, and is absorbed, as well as understand the electronics and systems we use to transmit sound from one place to another.

Learn about **more careers** that use engineering!

MINNESOTA ACADEMIC STANDARDS FOR SCIENCE K-12

3.1.1.1.1 Provide evidence to support claims, other than saying "Everyone knows that," or "I just know," and question such reasons when given by others.

3.1.1.2.1 Generate questions that can be answered when scientific knowledge is combined with knowledge gained from one's own observations or investigations.

3.1.3.2.2 Recognize that the practice of science and/or engineering involves many different kinds of work and engages men and women of all ages and backgrounds.

3.2.3.1.1 Explain the relationship between the pitch of a sound, the rate of vibration of the source, and factors that affect pitch.

6.2.3.1.1 Describe properties of waves, including speed, wavelength, frequency and amplitude.

6.2.3.1.2 Explain how the vibration of particles in air and other materials results in the transfer of energy through sound waves.