Creating a Water Xylophone

OVERVIEW

Using only water and drinking glasses, students will create their own water xylophone and discover the relationship between vibrations and the sound we hear.

TOPIC AREA(S)	**GRADE LEVEL**
Sound/Physics **Engineering**	Grade 3/4 **or any grade**

QUESTIONS PRIOR TO THE LESSON/GETTING EXCITED

- What makes sound?
- Have you ever heard crickets chirping? Ever wonder how they make that sound?
- What sort of sounds do we hear that are high-pitched? Low pitched?
- How do we hear sounds from far away? from underwater?

BACKGROUND INFORMATION FOR INSTRUCTORS (INCLUDE QUESTIONS W/ ANSWERS)

What makes sound?

Vibrations make sound! Vibrations are rapid back-and-forth movements. To understand vibrations, students should start humming and then touch either side of their throat, in order to feel their larynx vibrating. This is how we speak!

The chirping noise that crickets make is a vibration too - crickets make noise by rubbing their front wings together. There is a vein on the underside of the wings, which rubs across serrations (the jagged surface) of the wing to produce the characteristic cricket sound.

Demonstrating vibrations

Make sounds with a variety of different objects, then pick one; does it have a high pitch or low pitch, is it loud or soft? Take a ruler, and place it at the edge of a desk so that the majority of the ruler is hanging off the desk/table (demo in video) and whack the end that is hanging off. The ruler will vibrate up and down and produce a low-pitch sound. How can we raise the pitch of the sound? We can move the ruler closer to the desk! This will shorten the length of the ruler that hangs off the desk, causing the ruler to vibrate faster, thus raising the pitch of the sound.

Low pitch - slow vibrations
High pitch - fast vibrations

How do we hear sounds from far away?

In order to make/hear sound, three things vibrate,

1. the source object (person yelling, drum, music)
2. the molecules in the air

    a. air molecules bump into nearby air molecules which bump into more air molecules etc. sort of like if you were in a crowd of people and someone pushed you, or dominos!
3. the eardrum
    a. The eardrum receives the vibrations and allows us to hear the sound

Even though we can't always see them, vibrations travel from the source of the sound, through the air, and eventually reach our ears!

You might think you would be able to make a sound by waving your hand in the air. You wouldn't be able to hear it because the vibration isn't fast enough. The slowest vibration the human ear can hear is 20 times/second. This sound would be very low.

Sound travelling

As we know, sound can travel through air, but it can also travel through water or even solids. The way that we hear sound underwater is different from the way we hear sounds in air. Sound that is made underwater tends to stay underwater, very little sound travels from water into the air.

Now we will use all of our knowledge of vibrations and sound to create a water xylophone!

RELEVANCE TO THE CURRICULUM

Grade 1 and 2	Grade 3 and 4	Grade 5 and 6	Grade 7 and 8
€ Needs & Characteristics of Living Things € Growth and Changes in Animals € Materials, Objects and Everyday Structures € Movement € Energy in Our Lives € Properties of Liquids and Solids € Daily and Seasonal Changes € Air and Water in the Environment	€ Growth and Changes in Plants € Habitats and Communities € Strong and Stable Structures € Pulleys and Gears € Forces Causing Movement € **Light and Sound** € Soils in the Environment € Rocks and Minerals	€ Human Organ Systems € Biodiversity € Forces Acting on Structures and Mechanisms € Flight € Properties of and Changes in Matter € Electricity and Electrical Devices € Conservation of Energy and Resources € Space	€ Interactions in the Environment € Cells € Form and Function € Systems in Action € Pure Substances and Mixtures € Fluids € Heat in the Environment € Water Systems

MATERIALS (SPECIFY WHETHER PER CAMPER, GROUP OR CLASS)

Per student

- ruler for warm-up activity
- 5 to 8 drinking glasses or mason jars, preferably identical but not a necessity
- metal spoon, wooden spoon or other utensils to sound glasses

Optional: food colouring

SAFETY CONSIDERATIONS

Use caution when handling glasses, be sure not to hit the glasses too forcefully.

PROCEDURE

This is an inquiry-based activity, so the procedure is flexible!
Modification - do the activity first, then learn from the lesson.

1. Place 5-8 drinking glasses on a flat surface
2. Fill the first glass full of water (or close to full)
3. Fill the second glass with a little less water than the first.
4. Continue to fill each glass with less water than the previous one, with the last glass containing NO water.
5. For more fun, add a few drops of food colouring to each of the glasses and stir!
6. Using the spoon, lightly tap the sides of the glasses in order, and observe how the glass that contains the most water produces the lowest pitch sound.
7. It might be necessary to adjust the amount of water in each glass in order to achieve the desired notes.
8. Challenge yourself to reproduce well-known songs like Mary Had a Little Lamb, or Twinkle Twinkle Little Star.

Going further:

- For a challenge, use different sizes of glasses in order to make your xylophone
- Try using a different object to tap the sides of the glass, does this affect the sound?
- Tap the glasses across the top, rather than on the side of the glass - does the sound change?
- Fill a few glasses with a different liquid, such as milk or juice and discover how these liquids will affect the pitch of the sound

REFERENCES

https://www.pbslearningmedia.org/resource/phy03.sci.phys.howmove.collage/understanding-vibration-and-pitch/
https://www.scienceworld.ca/resource/sound-vibration-vibration-vibration/
https://www.exploratorium.edu/theworld/sonar/trythis.html