Human Tuning Fork

Amount of time Demo takes: 2 minutes

Try this at home!

Lesson's Big Ideas

- **High School Big Idea**: When struck by the table, the metal bends and flexes microscopically (aka, it vibrates!). This creates sound waves that travel through the string and into your ears, making it possible for you to actually hear each sound waves. The items all sound different because they have different lengths and metal compositions - so the sound has a different frequency and pitch.
- **Elementary Big Idea:** When the metal hits the table or the floor, sound waves travel up the string and into your ears.

Materials

- 1 metal spoon
- 1 metal spatula
- 1 metal slinky
- Pieces of string to be cut at approximately 3 to 4 feet long
- Scissors
- Demo needs to be located next to a hard surface like the edge of a table

SAFETY!

- Person doing the demo will need a reasonable amount of space around him/her to avoid anyone else getting hit with metal objects.

Background Information

- Vibration: the rapid movement of a material back and forth.
- Sound waves: sound waves are the noise caused by waves traveling through some kind of medium, whether that is through air molecules or the metal molecules in the spoon/spatula/slinky. Metals are great conductors of sound waves because, as solids, their molecules are packed very tightly together. That means the sound waves can vibrate the molecules more efficiently.

Setup instructions

1. If they aren't already in the bin, cut pieces of string to be anywhere from 3 - 4 feet long.
2. Loop string around the top of the handle of the spatula so that there is an even amount of string on each side.
3. Loop string around the bottom of the handle of the spoon so that there is an even amount of string on each side.
4. Loop string around one end of the slinky so that there is an even amount of string on each side.

Instructional Procedure

1. Once the strings are properly looped around each object, have the student pick which object they would like to use first

(Spoon and Spatula)

1. Have the student wrap each end of the string around their index finger a few times to ensure that it won't slip off during the demo.
2. Then have the student place their fingers in their ears with the string wrapped around the same fingers.



3. Make sure that the object on the string is hanging in the middle properly.
4. Have the student move their head to (gently) bang the end of the object against the end of the table.

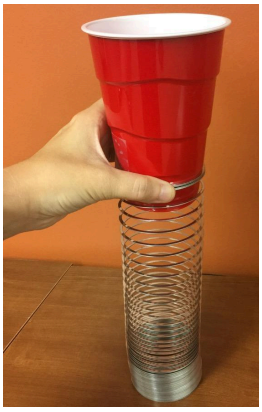
(Slinky)

1. Have the student wrap each end of the string around their index finger a few times to ensure that it won't slip off during the demo.
2. Then have the student place their fingers in their ears with the string wrapped around the same fingers.
3. Hold the slinky in the middle of the string, make sure the string is fully extended.

4. When the student is ready, drop the slinky to the ground.

Tips and Tricks

- Make sure that the spoon/spatula are hanging in the center of the string.
- Make sure that the slinky is centered on the string and that it is wrapped around the wire enough so that it won't slip off during the demo
- If you are at an especially busy venue where swinging-around space is limited: set up multiple students with spoons. Rather than having them swing the spoon to hit the table, just use the spatula to go 'down the line' and tap on all of their spoons.
- Another fun thing to do (right): tape a slinky to the bottom of a plastic cup. Hold it so that you are only touching the plastic cup, then drop the slinky - you can hear the cool sound effect amplified through the cup!



Assessment Questions

1. Can you hear the sound waves?
    a. Should be Yes; if no, have them move their fingers and try again
2. Why do the items each sound different?
    a. Items of varying size and material transmit waves differently.
3. Why does the slinky sound so weird?
    a. It's springy - the whole thing is making waves while sound waves are also going through it. That causes changes in the sound waves.

Careers & Real-World Applications

- This is similar to how a tuning fork works - striking the metal causes it to vibrate. The vibration/resonance creates the sound that you hear.
- Instruments also work by being made of materials that vibrate/resonate when struck (think xylophone).
- Sound engineering; physics; music; everyday life

Clean Up

- Everything from this demo should be saved. The only thing that should be replaced is the string if it becomes frayed or dirty.

References

- http://www.monstersciences.com/sound/sound-experiment/

- https://www.youtube.com/watch?v=lI8gH43lL2o
- http://www.learnnc.org/lp/editions/biomusic/6517

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- K-5
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