STEM Program

Seeing Soundwaves

Sound Waves – Magic of Music

Have you ever wondered what the sound coming out of a speaker is and how you might be able to see it? With this challenge card, you can explore soundwaves and their vibrations.

Suited to Section

Joey Scouts | Cub Scouts | Scouts | Venturer Scouts | Rover Scouts

Challenge Area

COMMUNITY | PERSONAL GROWTH | OUTDOORS | CREATIVE

Key SPICES Growth

SOCIAL | PHYSICAL | INTELLECTUAL | CHARACTER | EMOTIONAL | SPIRITUAL

Likely Scout Method Elements

COMMUNITY INVOLVEMENT | LEARNING BY DOING | NATURE AND THE OUTDOORS | PATROL SYSTEM

PERSONAL PROGRESSION | PROMISE AND LAW | SYMBOLIC FRAMEWORK | YOUTH LEADING, ADULTS SUPPORTING

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Plan

1. Investigate vibrations and their importance in music and sound.
2. Examine how sound waves are measured and at what frequencies humans can hear. You might also want to look at factors that affect the frequencies that we can hear and why, and what frequencies different animals can hear.
3. Investigate how deaf musicians, such as Mandy Harvey (https://www.youtube.com/watch?v=ZKSWXzAnVe0), use vibrations to perform.
4. Investigate oobleck and what properties are special about it.
5. Read the safety section of this activity and make sure everyone is aware of the safety risks and requirements.
6. Collect all the necessary materials for your experiment.

Do

1. Set up a large subwoofer speaker by placing it on a flat surface, and hook it up to a phone, tablet, or computer. This experiment works best with loud sounds at low frequency – think of songs with strong bases, so a subwoofer speaker works best, however smaller speakers for home entertainment units or computers may also work to varying degrees. The speaker will likely get some oobleck on it, so it is best to use a speaker that you don't mind getting messy.
2. Test that your speaker works, especially with a low frequency tone (about 40 Hz is a good start). You can use an online tone generator such as this one: https://onlinetonegenerator.com/
3. Place a candle in front of the speaker and light the candle.
4. Play a tone at 10 Hz and observe how the flame reacts in a longitudinal fashion.
5. See how the candle reacts at other frequencies.
6. Extinguish the candle and turn the speaker so that it is lying with the output facing upwards.
7. Cover the speaker with either plastic wrap or a plastic lid. This will help protect your speaker but also create a surface for the vibrations to travel through. A plastic lid works well as the rim will assist in keeping the oobleck on the lid. If you are using plastic wrap, you should make sure that the wrap is not pulled too tightly and has some give but not so that it touches the bottom of the indent of the speaker, if there is one. You can fasten the plastic wrap with either tape or rubber bands.
8. Make your oobleck by mixing two parts corn starch with one part water. You can also add a few drops of food colouring to make your oobleck more colourful.
9. Place a few tablespoons of oobleck on the plastic wrap or lid.
10. If you are using a plastic lid, hold it tightly against the speaker.
11. Play a low frequency tone and watch your oobleck dance. If it doesn't dance, you may need to gently poke it to "activate" it.
12. Experiment with different frequencies to see how it affects the way the oobleck dances. 40 – 80 Hz tends to work best.
13. See how oobleck dances to your favourite song, the Periodic table song (https://www.youtube.com/watch?v=rz4Dd1I_fX0), or another science-based song.

Review

1. Did your oobleck dance as you expected? Why or why not?
2. What did you enjoy the most from making oobleck dance? What did you learn?
3. If you were to do this activity again, what would you do the same? What would you do differently?

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Variations

- Experiment with different size speakers and different speaker volumes. How do they differ?
- Depending on the section, various parts of this challenge card may need to be completed by leaders.
- This challenge card pairs well with other Magic of Music themed challenge cards or other challenge cards on sound waves.

Safety Tips

- Sound warning: This challenge card uses loud noise and caution should be taken to protect hearing. This challenge card may not be suitable for noise sensitive individuals.
- Electronics warning: Always be careful when handling electronics and ensure that relevant safety procedures are followed.
- Fire warning: Youth members should be monitored around open flames and standard fire safety procedures should be followed.

Why Does This Happen?

Sound waves are vibrations through the air. As we cannot see the air, we cannot see these vibrations. However, by using another substrate for the vibrations to travel through, we can visualise these waves. By placing a lit candle in front of a speaker, we can see the longitudinal nature of sound waves, which follows the air thereby making the flame move.

Oobleck is a non-Newtonian fluid and acts like both a solid and a liquid depending on the pressure imparted on it as the corn starch particles move against each other in the suspension. The vibration from sound causes the oobleck to move. Lower pitched sounds have a lower frequency, as such, there are fewer vibrations per second and there is less force put on the corn starch particles. This, in term, causes lower pitches to cause more movement of the oobleck as it will act more as a liquid than a solid.

SciScouts Physics of Waves

The SciScouts Physics of Waves is a National Science Week project, undertaken in collaboration with Fizzics Education. These instructions were prepared by Scouts for Scouts. This National Science Week project is supported by the Australian Government.

Scouting has always been strong on STEM skills. Maths to calculate catering quantities and navigate, the science of water purification, the physics of abseiling, and the engineering of pioneering structures – they all have their place. In the current program for our youth members, STEM and Innovation forms one of six Special Interest Areas that enable Scouts to set goals and pursue their own ideas.

SciScouts PHYSICS

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