

Instructor: Ailen Borres

Week: 5

Subject: Science

Perfect Pitches with a Rubber Band Guitar

Description of Activity

We are surrounded by sounds every day, ranging from unpleasant ones like traffic noise to enjoyable ones like music or singing birds. What makes these sounds different? Why are some louder or higher pitched than others? In this lesson plan, your students will investigate how the properties of a sound wave, like frequency and amplitude, affect the sounds we hear. They will do this using a sensor app that can record sound and frequency data with a mobile phone and a homemade musical instrument—a rubber band guitar!

Learning Objectives:

After this lesson, students will be able to

- Draw and identify wave patterns with varying wave characteristics such as different frequencies and amplitudes.
- Describe how wave characteristics such as frequency and amplitude correspond to sound pitch and sound volume.
- Understand how to generate high/low pitch notes with varying volumes using a string instrument.

Standards:

STANDARD: 3	Students investigate energy and how it is transferred and transformed within and between systems.
BENCHMARK: PS1 3.4	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
	Formulate the relationship between wavelength, frequency, and velocity.
	Calculate wavelength, frequency, and velocity of various wave types.
	Identify patterns of transmission of sound waves in different media

Materials Required:

- Rope or Slinky
- Scissors, or box cutter if you are using cardboard boxes
- Materials per group of students:
- Cardboard box or tissue box (with single hole on one side)
- Rubber band big enough to stretch around the box and cover the hole

- Pencils, markers, or crayons (2)
- Smartphone with a sensor app such as phyphox, available for free on [Google Play](#) for Android devices (version 4.0 or newer) or from the [App Store](#) for iOS devices (iOS 9.0 or newer).

Learning Activities:

- In this lesson plan, your students will investigate how the frequency and amplitude of a wave are related to the pitch and volume of a sound by making music with a rubber band guitar. To do this, they will use an app on their phones, which uses sensors that are built into many smartphones, including a microphone that you can use to measure sound. The app helps your students to record and visualize the pitch and sound intensity of the sounds they create with their instruments, allowing them to discover the relationship between the properties of the sound waves and what they hear themselves.
- <https://www.sciencebuddies.org/teacher-resources/lesson-plans/sound-wave-frequency-amplitude>
- **KEY CONCEPTS**
 - Sound wave
 - Frequency
 - Amplitude

Safety:

Always wear a Safety glass in a lab setting.

References:

- <https://www.sciencebuddies.org/teacher-resources/lesson-plans/sound-wave-frequency-amplitude>
- Website: www.guitarbuilding.org
- ASDOE Curriculum

Assessment: *Formative/Summative*

- Online quiz, assignable in Google Classroom
- Quiz (pdf) and answer key (PDF)
- <https://www.sciencebuddies.org/Files/12188/11/ScienceBuddies-PerfectPitches-quiz-phyphox.pdf>

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