

Great Guitars!

FRAMEWORK

- I. Scientific and Engineering Practices 4
- II. Cross-Cutting Concepts 2
- III. Disciplinary Core Ideas PS 1, PS 2, ETS 2

SKILLS/OBJECTIVES

- To understand how sound is created
- To understand frequency and its relationship to wave shape
- To make guitars

MATERIALS

- 15-20 slinkies
- 15- 20 Small cardboard boxes (half a Pi sandwich box)
- 80 Rubber bands

NOTES

- The slinky activity can be done in a large group or in small groups

BACKGROUND

- Wesleyan wants to make a band, but we need instruments to play. We need your help to make musical instruments!
- First, we need to know a little bit about sound. What do you know about sound?
- Sound comes from sound waves – vibrations in the air that get absorbed by your ear.
- Instruments use different materials to vibrate the air. Can you name some instruments? What do they use that makes the air vibrate? (String instruments like guitar, violin, and piano use strings; wind instruments like trumpet and flute use lips; reed instruments like clarinet and oboe use reeds; percussion like drums use the drum head.)
- Sound terms:
 - **Pitch** – how high or low a note is. Pitch depends on the wave frequency – how fast or slow the waves are.
 - **Loudness** – how loud or soft a note is. Loudness depends on wave amplitude – how high up the wave goes on a graph.
 - Note: don't need to go into graphs of waves (ie. frequency and amplitude), but make sure they can differentiate pitch and loudness.

Activity # 1	Wave Dance
Materials	-kids and their bodies
Worksheet	no

- **Have kids stand up in a circle holding hands**
- **Have the leader raise one arm and then the other, and have the students pass the “wave” around the circle. This is a low frequency wave. What kind of note does it make? (low note)**
- **Have the leader send multiple waves around the circle at the same time. This is a high frequency wave. What kind of note does it make? (high note)**

Activity # 2	Slinky Demonstration
Materials	o Slinkies
Worksheet	no

- **Pass out 1 slinky for every pair of children.**
- **Have children each hold one end of the slinky and wave it up and down to make a wave.**
- **Have the children make a low pitched wave (low frequency).**
- **Have the children make a high pitched wave (high frequency).**
- **Ask them to describe the differences between the waves. What do they have to do differently to make different pitches of waves?**

Activity # 3	Making Guitars
Materials	o Half of a Pi sandwich box (or any small cardboard box) o Rubber bands
Worksheet	yes

- **Pass out a sandwich box and 4 rubber bands to each student.**
- **Have children place the rubber bands around the box such that they cross the opening of the box.**
- **Have children pluck the rubber bands one at a time. Which rubber bands produce high pitches? Which produce low pitches?**
- **Have children stretch out the rubber bands and pluck them again. How do the pitches change?**

- **Based on their observations, have them arrange the rubber bands from highest to lowest.**
- **Now they have a guitar they can play**
- **Fill out the associated worksheet**

Conclusion

- Sound is made of pressure waves
- When you speak or pluck an instrument, you make a vibration in the air
- That's why all instruments need a component that vibrates. Guitars and pianos have strings, clarinets and saxophones have reeds, and tubas and trumpets have your lips!
- There can be no sound where there is no air to vibrate. That's why there isn't sound in space! The molecules are too far apart to effectively pass along the vibration.
- If sound waves are just pressure waves, is it possible to make sound in water? How about in a solid object? In which state, gas, liquid or solid, do you think sound travels fastest?
- Sound travels at 340 meters/second, or ~ 0.34 km/s or ~ 0.21 miles/s
 - So during a storm, you can count the number of seconds between thunderclaps and multiply by 0.21 and you can find out how many miles away the storm is!



Name: _____

Great Guitars!

Today we will be making our own guitars! But first, we need to understand sound.

Sound comes from **sound waves** – vibrations in the air. Below are pictures of two sound waves. The **pitch** (how high or low a sound is) is based on how fast the sound waves are. Faster sound waves produce higher sounds. Circle the sound wave that you think produces a **higher** sound.



Now let's make our guitars!

1. Place 4 rubber bands around your box so they go across the open side.
2. Pluck each rubber band one at a time with your finger to play a note.
3. Now test the different rubber bands on your guitar!

	High pitch	Low pitch
Thin rubber band		
Thick rubber band		
Loose rubber band		
Tight rubber band		