

Sound

FRAMEWORK

I. Scientific and Engineering Practices

II. Cross-Cutting Concepts

III. Physical Sciences

SKILLS/OBJECTIVES

○ To understand how sound moves through space

○ To understand how pitch differs with frequency

MATERIALS

○ Materials List

○ 120 rubber bands (half thin, half thick)

○ 10 slinkies

○ Tuning forks of different pitches

○ Bucket of water

○

NOTES

The slinky and tuning fork demonstrations can be done in a large group, in small groups, or as stations.

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 (play 2 different tuning forks to compare pitches). Pitch depends on the wave frequency – how fast or slow the waves are.
 - **Loudness** – how loud or soft a note is (play the same tuning fork hitting it hard the first time (loud) and soft the second time (quiet)). 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	None
Worksheet	No

- **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?
- 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?

Activity #2	Wave Dance
Materials	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.
- **Use your slinky to make a low pitched wave** (low frequency).
- **Use your slinky to 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	Tuning Fork Demonstration
Materials	<ul style="list-style-type: none"> • Tuning forks of different pitches • Bucket of water • Ping pong ball attached to a string
Worksheet	No

- **Hold the string of the ping pong ball. Hit the tuning fork and touch it lightly against the ping pong ball.** The ping pong ball should bounce, showing the vibration of the sound wave. Try this with different pitches of tuning forks to see how the bouncing changes.

- **Hit the tuning fork and put the fork end into a bucket of water.** The water should make ripples, showing the vibration of the sound wave. Again, try with tuning forks of different pitches to see how the ripples change.

Activity #4	Making Guitars
Materials	<ul style="list-style-type: none"> • Half of a Pi sandwich box • Rubber bands (different thicknesses)
Worksheet	Yes

- Pass out a worksheet, a half-sandwich box and 4 rubber bands to each student. (At least one should be thin and one should be thick.)
- **Place the rubber bands around the box such that they cross the opening of the box. One should be a thin rubber band, one should be a thick rubber band, one should be tied loosely, and the last should be tied tightly around the box. (To make the last one tight, you can place two rubber bands together.)**
- **Pluck the rubber bands one at a time.** Which rubber bands produce high pitches? Which produce low pitches? **Fill out the worksheet with observations.**
- **Stretch out the rubber bands and pluck them again.** How do the pitches change?
- **Based on your observations, arrange the rubber bands from highest pitch to lowest pitch.**
- Now you have a guitar you can play!

CONCLUSIONS

- Sounds travel in waves. These sound waves push particles in the air, which pushes the next particle over, which pushes the next particle over, all the way until it reaches your ear. When the sound wave reaches your ear and vibrates your ear drum, that movement makes you hear the sound!
- Faster waves are said to have higher frequencies. High frequency waves make high pitched sounds.