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May 9th, 2020

Science of Music

In this lesson plan, we will be focusing on the scientific properties involved in the production of music. These properties include how different pitches are produced by changes in frequency with our xylophone water jars. In addition, we will be investigating frequency and pitch and how they can be changed by altering distance and tension. This will be done by our own homemade harmonica.

Key Words

Sound energy
Pitch
Frequency
Vibration
Wavelength

Material List

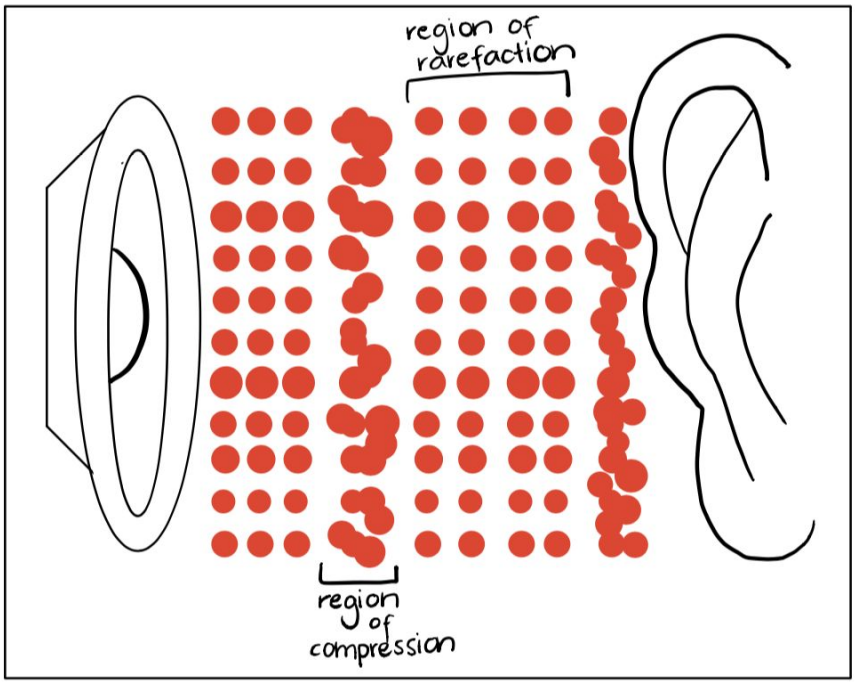
1. Water
2. Food coloring
3. Wooden sticks
4. 6 Glasses
5. Jumbo craft sticks (2)
6. 2 wide rubber band
7. 15 smaller rubber bands
8. A straw
9. Scissors
10. Ruler

Activities:

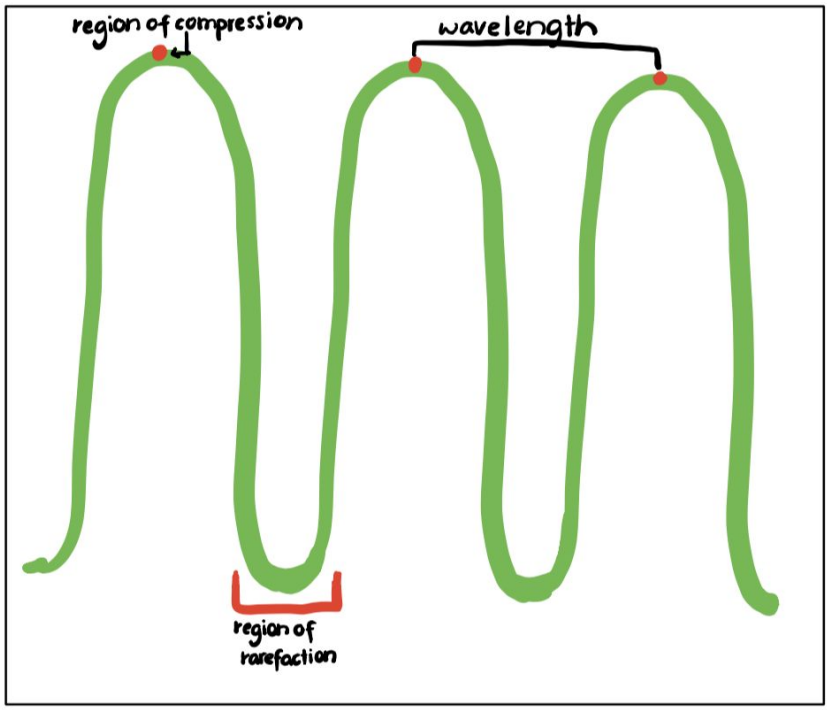
1. What is Sound?
Duration: [10 minutes]

https://youtu.be/l4-r9K23Fe4

Sound energy travels through the air by sound waves, composed of vibrating particles in the air. These vibrating particles form regions where they get very close (region of compression) and regions where they get far apart (region of rarefaction).

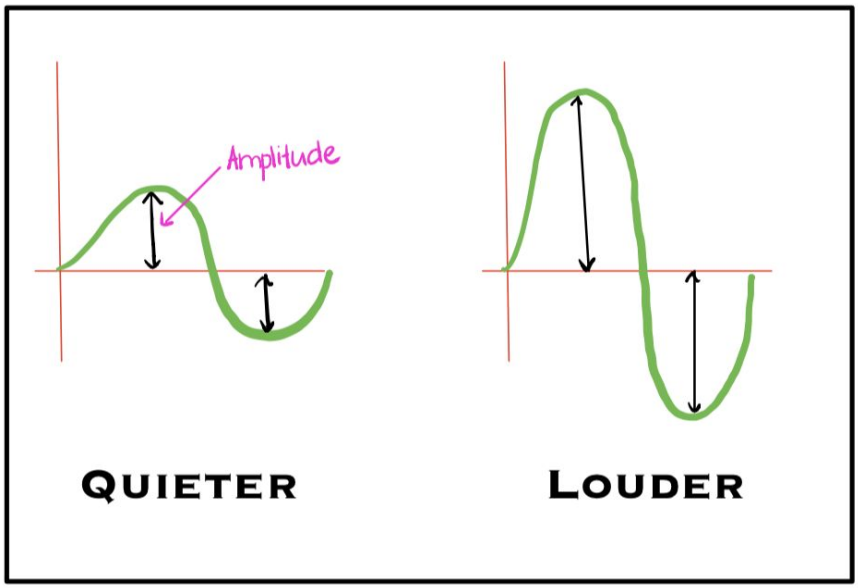


These regions are what form the sound waves that we can recognize easily.

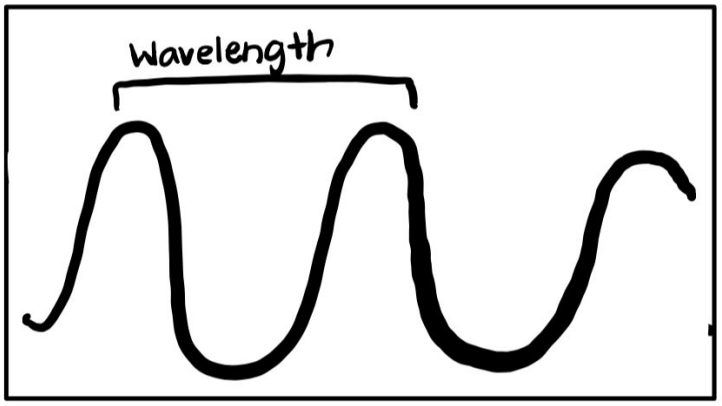


The type of sounds we hear is impacted by the nature of the sound wave. Let's learn some vocabulary.

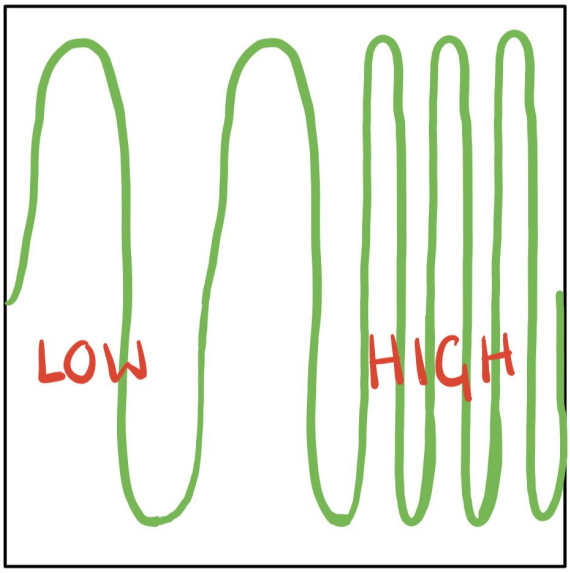
a) **Amplitude:** This is the "height of the sound wave" and it determines how loud the sound is.



b) **Wavelength:** the distance between crests of two waves



c) **Frequency**: the number of waves in a second and it determines the **pitch** of a sound.



A song will be made that explains the properties of sound.

Students should follow along using a lyrics worksheet and will be encouraged to fill in the blanks as the song is performed.

In the end, the kids will then sing along using their filled out worksheet which can be found in the materials folder for this topic.

Sound Song

Sound is super cool

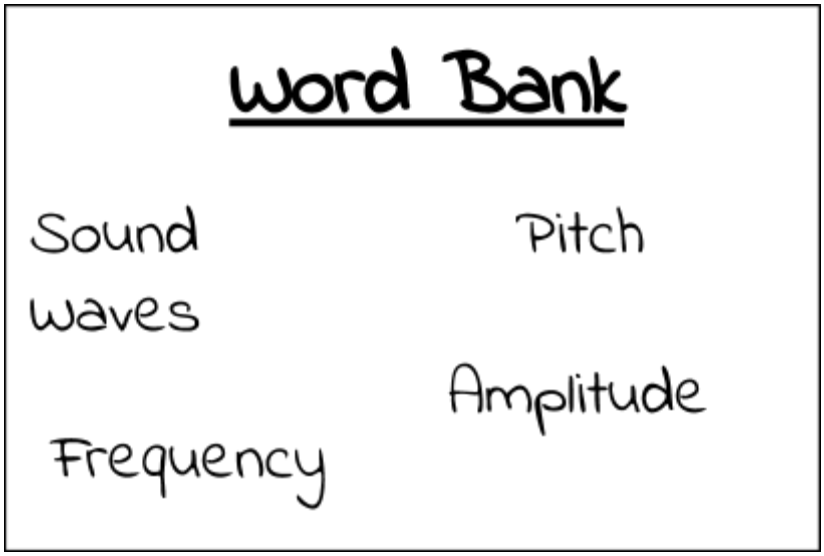
Let me teach you how you hear

Let the particles _____

Moving near and far

In other words, sound waves are formed

In other words, that's how we hear



Fill my life with song

Use _____ to make it loud

Make the _____ real quick

You'll hear the differences in _____

In other words, sound waves are formed

In other words, that's how we hear

Sound is super cool

Let me teach you how you hear

Let the particles vibrate

Moving near and far

In other words, _____ _____ are formed

In other words, that's how we hear

Sound Song

Sound is super cool

Let me teach you how you hear

Let the particles vibrate

Moving near and far

In other words, sound waves are formed

In other words, that's how we hear

Fill my life with song

Use amplitude to make it loud

Make the frequency real quick

You'll hear the differences in pitch

In other words, sound waves are formed

In other words, that's how we hear

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Let me teach you how you hear

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2. Xylophone Water Jars
Duration: [10 minutes]

https://youtu.be/k-WX7Z4V8EU

The properties of sound waves are impacted by the medium in which they are traveling. This experiment investigates how the **pitch** is impacted by the changes in medium and what this tells us about the properties of sound.

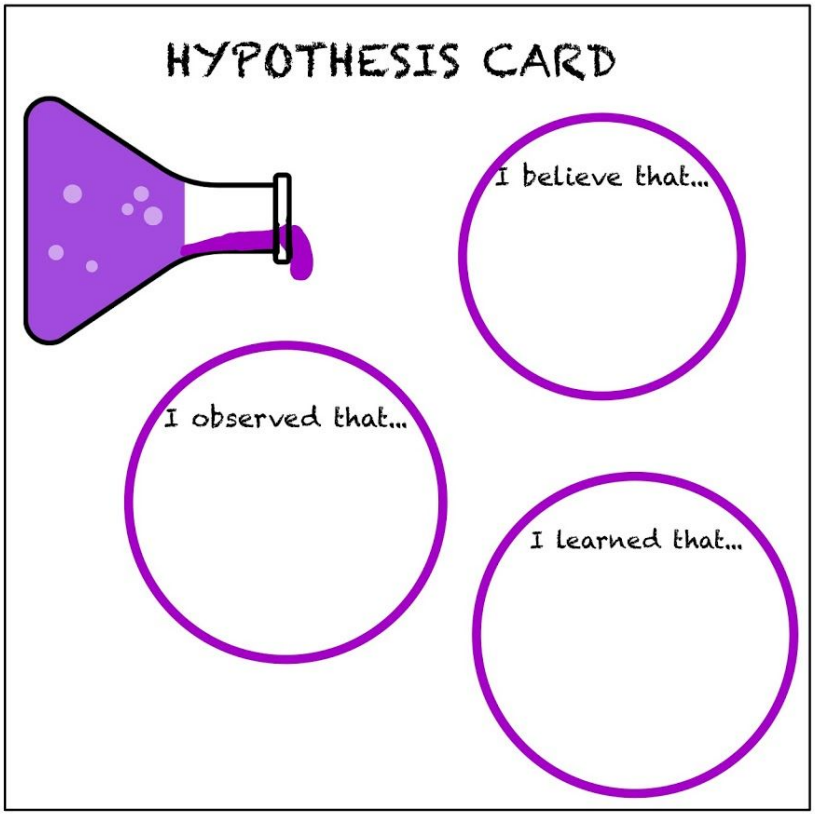
Experiment:

1. Place 8 empty glasses on the table and have kids tap the sides of the jar using a wooden spoon to hear the initial sound.
2. Have kids predict using hypothesis cards what they think will happen to the sounds when different volumes of water are added.
3. Then fill the jars with varying levels of water.
4. Add different colored food dye to each jar (optional).
5. Let kids tap the sides of the jar using the wooden stick and listen to the new sounds each jar makes.
6. Have them identify the differences between jars with more water and less water.
7. Let kids experiment with different songs using their new xylophone!

Explanation:

The medium sound waves travel through to affect the speed of the wave. In water, the particles are more condensed than air, making it harder for sound waves to move through it. This affects the frequency of the sound wave as the number of sound waves per second has changed. Therefore in our experiment, the greater the volume of water, the slower the sound wave travels through the glass. This produces a lower frequency and therefore a lower pitch. From our investigation, we can conclude that the jars with less water had sound waves of a higher frequency and therefore a higher pitch.

Below is a sample hypothesis card that the kids can use to make their own hypotheses during the investigation. This will be found in the materials folder.



3. **Homemade Harmonica**
Duration: [15 minutes]

https://youtu.be/G6gjRapOd2A

1. Cut the straw into two pieces (each roughly 1 inch long)
2. Stretch a wide rubber band around each of the craft sticks.
3. Place the straw under the wide rubber band of one of the craft sticks.
4. Place the other craft stick (with the rubber band) on top, tightly attaching the side with the straw with a small rubber band.

5. Insert the second straw under the wide rubber band of the second craft stick on the opposite side of the initial straw.
6. Secure tightly that end with a small rubber band.
7. Blow in the center of the harmonica to hear the sound.
8. Experiment with your instrument:
    a) Adjust the distance between the two straw pieces to adjust the pitch.
    b) Adjust the blowing technique to produce different sounds.
    c) Blow on different areas of the harmonica
    d) How tight the small rubber bands are attached

Explanation:

- Blowing into the harmonica causes the particles in the air to vibrate.
- These vibrating particles make the large rubber band vibrate, producing sound.
- The longer the distance the sound wave has to travel (or the longer the object) the slower the sound wave travels; this produces a low pitched sound.
- The shorter the distance, the faster the sound wave travels, producing a higher-pitched sound.
- The tension of a rubber band also will change its pitch: Higher tensions lead to higher-pitched resonances.

- The shorter the distance between the straws means the shorter the part of the rubber band that can vibrate, therefore pitch is higher.

References:

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5. *Life Is by Cosimo Fogg (201) https://soundcloud.com/cosimo-fogg, Creative Commons — Attribution 3.0 Unported— CC BY 3.0 Free Download / Stream: https://bit.ly/ life-is Music promoted by Audio Library* *https://youtu.be/9MXUHYGvBVY*