

Week One

General Theme: *How sound causes vibrations in things around us, just as they do in our eardrums!*

Materials

- Parchment or wax paper
- A large rubber band that will fit around the top of a glass bowl (An elastic headband works well, too.)
- A small glass bowl large enough to rest a Bluetooth speaker at the bottom
- Sugar or salt (To help you see the results better, you can use colored sugar sprinkles or you can color the sugar or salt yourself with food dye.)
- A portable Bluetooth speaker
- A phone or other device that can connect to your speaker (For this activity you will play one single tone at a time from the device. There are several free tuner apps available as well as YouTube videos that you can use to play single tones from your phone. Be sure you have permission to add apps to the device.)
- Ear plugs (optional)

Procedure

- Open the tuner app (or a YouTube video playing one single tone) on the phone or device. Start with the lowest frequency tone available. Set your volume to the lowest possible setting and hit Play.
- While the tone plays, observe the sugar or salt granules on the paper. *What do you notice about the granules? Are there any changes? If so, what are they?*
- Slowly increase your phone's volume. Each time you increase it pause to observe the sugar or salt. *What do you notice? Have the granules changed? In what way?*
- Continue to increase the volume, observing any changes to the sugar on the paper. (Important: Keep your speaker volume within a comfortable range. If the volume starts becoming uncomfortably loud and you still do not see any changes, see the first "Extra" step below for tips.) *What effect does increasing the volume have on the sugar or salt? What do you think is causing this change?*
- When you see an effect on the sugar or salt, try pausing the tone and then restarting it. *When the tone stops, what happens to the granules? What about when you restart the tone? Why do you think the tone has this effect on the granules? Do you notice any patterns in how the granules behave when the tone is playing?*
- Pause the tone and reset the sugar or salt so that it is evenly spread across the paper again.
- Set your phone back to the lowest volume and change the frequency of the tone that you are playing to a higher frequency

- Repeat the activity, slowly increasing the volume for this new tone. *How is the new tone different? Does it sound higher or lower? How does the new tone affect the granules? Is the effect different than what you observed with the first tone? If so, in what way? What do you think causes the difference between the two tones?*

2. Water and Sound Experiment

Materials

A powered speaker, Water source, Soft rubber hose, Tone generating software, 24 fps camera
Tape

Procedure

Run the rubber hose down past the speaker so that the hose touches the speaker. Leave about 1 or 2 inches of the hose hanging past the bottom of the speaker. Secure the hose to the speaker with tape or whatever works best for you. The goal is to make sure the hose is touching the actual speaker so that when the speaker produces sound (vibrates) it will vibrate the hose. Set up your camera and switch it to 24 fps. The higher the shutter speed the better the results. But also keep in the mind that the higher your shutter speed, the more light you need. Run an audio cable from your computer to the speaker. Set your tone generating software to 24hz and hit play. Turn on the water. Now look through the camera and watch the magic begin. If you want the water to look like it's moving backward set the frequency to 23hz. If you want to look like it's moving forward in slow motion set it to 25hz.

Week Two

General Theme: *Pitch amplitude and resonance*

1. Amazing Resonance Experiment!

Materials and Procedure

This experiment is the Chladni plate experiment. We need a tone generator, a wave driver (speaker) and a metal plate attached to the speaker.

1. First add sand to the plate then begin playing a tone.
2. Certain frequencies vibrate the metal plate in such a way that it creates areas where there is no vibration.
3. The sand "falls" into those areas, creating beautiful geometric patterns.
4. As the frequency increases in pitch the patterns become more complex.

2. Pitch in different objects

Materials and Procedure

- i) Each glass is filled with a different volumes of water, ranging from just half empty to almost full. This is an experiment to look into how the pitch changes as I hit each glass in sequence.
- ii) Have you ever wondered why the strings in a piano are of different lengths? In this activity we see how the frequency or pitch of a wire depends on its length. Take a box and stretch a rubber bad around it as shown in the video. Put two pencils beneath the band and listen to the sound produced on plucking the band. Keep increasing the distance between the pens and listen to the sound produced each time. You will notice that at the shortest length the sound is sharp and as the length increases the pitch becomes lower. In musical instruments, we either have strings of different lengths (piano, harp) or use our hands to change the length of the strings (guitar, violin) and thus produce sounds of different pitches.

Week Three

General Theme: *Biology of hearing*

1. How to Make a Model of an Ear for Children

Materials and Procedure

5. Carefully cut out two sides of a medium size, rectangular, cardboard box. Both rectangles need to be the same size, then cut both rectangles in half.
6. Place the side of the cheesecake pan on the cardboard. Allow one half of the circle to lie on the cardboard, and one half of the circle to lie on the table.
7. With the pencil, draw a semi-circle around the outside of the cheesecake pan on the cardboard. Repeat with the other piece of cardboard. Carefully cut the semi-circle shapes out of both pieces of cardboard.
8. From the remaining cardboard, make a stand for the two semi-circle pieces of cardboard by cutting two pieces of cardboard, each one should have two identically measured slits on either side of them. The two semi-circle pieces of cardboard will slide into these slits. The four pieces of cardboard should be used to form the capital letter "I," and will hold the spring form pan in place in the semi-circle cut out.
9. Spread plastic wrap across one side of the spring form pan. Secure the plastic wrap with a large rubber band. Make sure the plastic wrap is stretched tight like a drum.
10. Measure and cut a 3 inch equilateral triangle out of cardboard. Fold a flap along the base of the triangle. Fold the triangle in half. Glue the straight end of a bendable straw to the inside of the folded cardboard triangle to make the ear canal. Glue the triangle shut, and glue the triangle to the center of the plastic wrap

"ear drum." The opening of the straw should touch the plastic wrap drum in the center. Allow to dry. Bend the straw.

11. Attach a ping-pong ball to the end of the straw with double-stick tape. Pour water into a clear glass bowl or plastic tub. Dip the ping-pong ball into the water. It may be necessary to raise the water bowl with a stack of books for it to be even with the drum.
12. Make sounds behind the drum without touching it and watch the water ripple from the sound waves.

WEEK 4

General theme- Introduction to music making technology

Activity 1- Bending water with a speaker

Discuss the speaker as a piece of technology that created vibrations in the air that we can here as sound (refresher). Then ask them to look at the speaker and figure out which part of the speaker is creating these vibrations in the air. Play different tones and have the students make observations.

Using a large speak and a hose, run a steady stream of water in front of the speaker cone.

Gather students around and have students observe the stream of water. Play different tones through the speaker and observe how the stream of water is deformed and forms different shapes at different tones.

Ask the students to think about what is making the water stream change shape.

Ask students to think about what would happen if we moved the stream further away from the speaker. Ask students which tones they think may work better or worse and why.

Test out student's predictions.

Activity 2- Music jars

Students take 4 glass jars and fill them to different levels with water. They can use food colouring to make the difference in volume of water more obvious.

Students gently strike each jar with a spoon. Ask students what they observe about the sounds.

Have students arrange jars from highest pitch to lowest pitch

Now have students add ping pong balls to each jar. What does that do to the sound? Why might that be? Sound is a vibration. So what is vibrating? Why does adding a ball change that?

Add in popsicle sticks. How does that change the sound? Why is there a difference in the change from adding a ping pong ball and adding a popsicle stick?

Activity 3- Laser vibration detector build

Students build a vibration detector by stretching plastic wrap over the opening of a plastic cup and remove the bottom of the cup. Glue a small piece of mirror into the center of the plastic wrap skin.

Students place vibration detector in front of a speaker.

Using a laser pointer, students point the laser at the mirror so that the beam reflects back onto a flat wall.

Play music through the speaker and observe the movements of the laser

Students predict what genre of music will produce the most vibrations- ballads, heavy metal, pop or rock. Test their predictions.

Groups choose song they think will produce most movement of the laser. As a class test each song and make group observations.

Activity 4- Plan your musical instrument build

Students are given a list of materials and told that next class they will build their own musical instruments. Students must plan and draw their musical instruments and make a complete list of all the materials they need

WEEK 5

General theme- Building musical instruments and editing music

Instrument 1- Popsicle stick harmonica.

Each student cuts a strip of paper the same length and width as a popsicle stick. Then place the paper between two popsicle sticks like a sandwich (paper is the meat, popsicle sticks are the bread). Students take 1 inch pieces of straw and place at each end of the sandwich and hold the popsicle sticks together with rubber bands at each end. When they blow through, paper will vibrate making a sound. If they move the straws closer together the pitch will change.

Instrument 2- Spin drum

Students take 2 circles of card and glue them to each side of a jar lid.

Take two 3inch strings and tie a knot on one end of each. Thread a bead onto the string making sure the knot is big enough to stop the bead falling off. Glue one string to the edge of the jar lid, glue the second one on the edge opposite.

Glue a straw to the bottom edge of the jar lid as a handle. Rub the handle between hands and beads should strike the cardboard circle making a sound. Decorate

Instrument 3- Self-designed instrument

Students build the instruments they designed in week 4

Editing music-Edity app on ipads

Using the edity app on ipads, students record various sounds and edit it using the features of the app, such as pitch change, rate change, echo, copy, cut. Students create their own melodies using the app. The app is fairly intuitive, a short tutorial using the document camera should allow them to get to grips with the basics, more advanced things they can learn via experimentation.