

Standing Waves



**IMPOSSIBLE
SCIENCE**

Objective: Students will create and observe visual displays of sound vibrations, and they will create their own artworks inspired by different types of music.



Materials:

- A wide pipe, tube, or drum with an open end such as a paint bucket or a coffee can.
- Plastic to stretch over the pipe such as plastic cling wrap, trash bags, or packaging.
- Tape such as duct tape to secure the plastic to the pipe.
- Speakers and/or instruments such as horns, kazoos.
- Construction paper or thin cardboard such as is used in food packaging
- Sand and rice.
- Paper and drawing tools (one or any combination of paint and paintbrushes, sharpies, colored pencils, crayons, or oil pastels)

Anticipatory Set

Ask students to journal for a few minutes in response to the questions: “What does sound look like? What does music look like?”

Procedure

1. Have students turn and talk about their responses, and invite a few to share.
2. Explain that some artists are thought to have experienced synesthesia, where one sense is stimulated by another- for example they might see music as an array of visual shapes and colors. The Russian artist Wassily Kandinsky demonstrated this

multisensory experience as he explored color and shape through music. Explain that although music can inspire artwork, it can also create artwork with its own vibrations.

3. Explain that today students will learn about a process by which sound vibrations create visual effects.
4. Review vocabulary.

Vocabulary

Wave: represents a disturbance traveling through a medium or space.

Cymatics: The study of the visual representation of sound waves and vibration. Standing Wave: When two waves traveling opposite directions with the same amplitude and frequency overlap creating a wave that does not appear to be moving.

Node: The part of the wave that does not look like it is moving.

Antinode: The part of the wave that is moving the most.

Tonoscope: an instrument that renders sound vibrations visually.

Synesthesia: a sensation produced in one modality when a sensation is produced in another modality. For example, an artist might hear a certain sound when they see color, or a chef might taste something when they hear certain sounds.

5. Explain that German physicist and musician Ernst Chladni (1756-1827), informally known as the father of acoustics, invented a technique that demonstrated a visual effect for sound vibrations where sand on a thin glass plate moved into different patterns, called nodal patterns, as the sand would gather in lines where no vibration occurred. Chladni would create vibrations on the plate by exposing it to sound. The patterns created became known as Chladni figures.
6. Show students a few examples of Chladni figures.



7. Show students Impossible Science Cymatics video, pausing for students to write down definitions and ask clarifying questions.
8. Explain to students that they will create their own tonoscopes and capture the visuals of different sounds.
9. Demonstrate for students how to stretch plastic film over the open end of a tube, drum, or bucket and secure it with tape so that it is pulled taught and smooth across the surface.
10. Tape construction paper around the edge to create a barrier to hold the sand inside.
11. Place sand or rice on the surface of the plastic film.
12. Blast music into the side of the tube or around the tube and watch as different Chladni figures are formed.

Assessment:

Working in mixed-ability small groups, students should build their own tonoscopes and choose three to six different sounds (loud trumpet, club music with heavy base, etc.) and take photos of the images they create with the sand or rice. Students should display their photos on a slide or poster with the sounds described and have the class guess which sounds created which patterns.

Extension:

Play a variety of different instrumental music with different pace and mood (jazz, classical, ambient, bluegrass, etc.), and invite students to create automatic artworks by moving their instrument (paintbrush, marker, oil pastel, etc.) to the sounds for two minutes each. Categorize the artworks by song and display.

Safety Note:

Adult Supervision Recommended

