



## The Voice of the Drum

### Learning Objectives

1. Learn types of sound waves (transverse and longitudinal) using the sound of the drum.
2. Explore what makes the sound waves of each drum different.
3. Learn how to use a Chladni plate and about chlandi figures.

### Background Information

The sound of the drum represents the heartbeat of mother earth. Each drum we make has its own voice based on where it has come from and how it is made. When a new drum has been made there is a ceremony to give the drum its voice. During the ceremony it is woken up and welcomed to the world. We see and use drums at community gatherings, powwows, and at home. There are two commonly used drums by Indigenous people. These include hand drums and the large drum.

Physics is a branch (on the tree) of science that is concerned with the properties of energy and matter. Physics can be used to show the differences between drums from a scientific perspective.

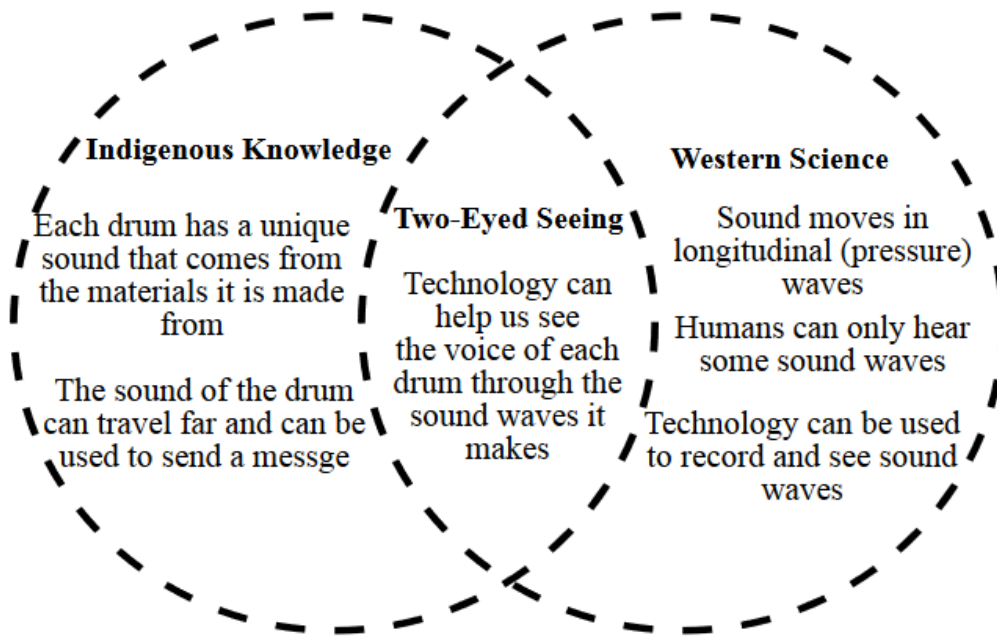




Figure 1: Two-Eyed Seeing Diagram

Table 1: Vocabulary

Longitudinal	Longitudinal waves are waves where the disturbance moves in the same direction as the wave (1). 
Transverse	Transverse waves are waves where the disturbance moves at a right angle to the direction of the wave (1). 
Crest	The crest is the highest part of a wave (1).
Frequency	How fast a sound wave moves is called the frequency (1).
Hertz (Hz)	Hertz is a unit used for measuring the frequency of sound waves (1).
Amplitude	Measures how strong a wave is. This is measured by how high and how low the wave goes (1).

## Questions and Answers about Physics and Sound

What is sound?

Sound is a type of energy created by vibrations of particles in the air. These vibrations are called sound waves. When your ear is within the range of the vibrations, you hear the sound (2).

What is physics and the science of sound?

Physics is the study of how energy is transferred. Acoustics is a branch of physics that studies how sound works (2).

What kind of careers involve the physics of waves?

- Radiologist (a doctor that specializes in x-rays)
- Engineer
- Physics Teacher
- Physicist
- Astronaut

What is a Chladni Plate?

A Chladni plate is a flat sheet of metal that vibrates when sounds go through it. By using sand or salt on top of the metal sheet you can make patterns with vibrations. These patterns are called Chladni figures. When we change the frequency of the sound, we can change the pattern that we see.

## **Part 1: Recording Soundwaves**

### **Objectives**

1. Review sound and sound waves
2. Record and analyze the sound waves created by different drums
3. Review why each drum has a different sound

### **Materials**

- A computer with microphone and Audacity software installed (Free software; see <https://www.audacityteam.org/download/>)
- 3 or more drums

### **What to do, step by step:**

Step 1: With a partner, choose one person to drum and one person to record using the audacity program.

Step 2: Review the directions below for using audacity.

Step 3: Record 3-5 drumbeats.

Step 4: Analyze the sound waves of your recordings

Step 5: Find and record the dominant frequency (Hz) in table 1.

Step 6: Draw a sketch of the sound wave in the box for drum 1.

Step 7: Repeat the process for the rest of the drums.

Step 8: Fill out the rest of table 1 by collecting the dominant frequencies from each group. Determine the average dominant frequency for each drum using the findings from each group.

## How to record on audacity

To record, press the red record button and to stop recording press the grey square button shown in figure 2 below.



Figure 2. Record and stop recording buttons

## How to analyze the sound waves in your recording

Use your computer mouse to choose your whole recording on the screen. To do this click on the left side of the recording and drag the mouse to the right end of the recording. The colour of the recording will be come lighter when you choose it.

At the top of the program click on the Analyze menu. Choose “Plot Spectrum” in the drop-down menu. A new screen will appear showing the frequency of the drum recording in a purple graph.

## How to find the dominant Frequency

Using your mouse point to the highest spot on the purple graph. In figure 3 you can see that the arrow is pointing to the highest spot on the graph. This point is called the crest and represents the dominant frequency. The cursor box under the graph shows the frequency measured in Hz.

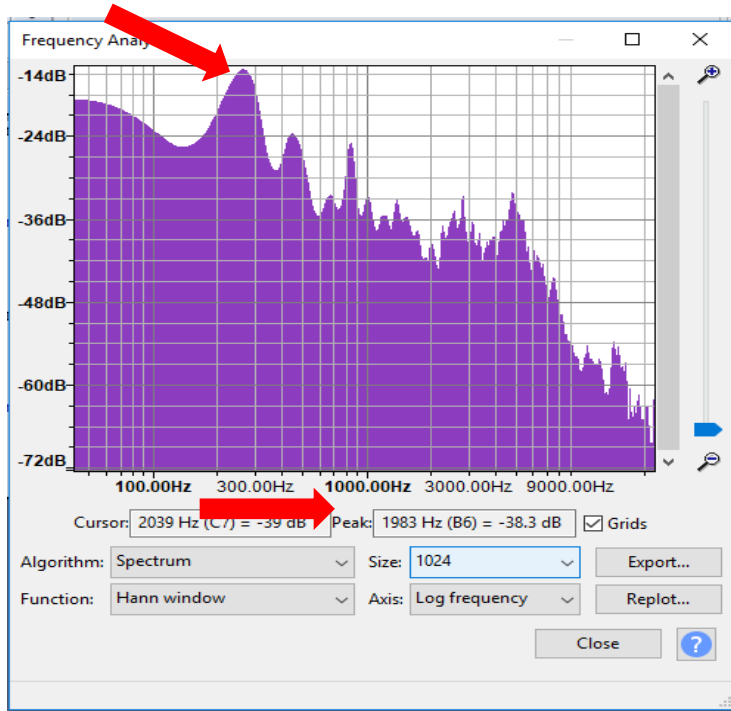


Figure 3. The dominant frequency

Table 1: Dominant Frequency (Hz) for Each Drum

	Drum 1	Drum 2	Drum 3	Drum 4
Group 1				
Group 2				
Group 3				
Group 4				
Average				

Box 1: Frequency drawings

Drum 1	Drum 2
Drum 3	Drum 4

## **Part 2: Using the Slinky to Learn About Sound Waves**

### **Objectives**

1. Review sound waves
2. Demonstrate the difference between transverse and longitudinal sound waves using slinkies

### **Materials**

- 1 slinky for each group of 2

### **What to do, step by step:**

Step 1: Sit across from your partner with each person holding an end of the slinky

Step 2: Create a transverse wave with the slinky. Have one person hold their end of the slinky still. Have the other person begin to move the other end of the slinky up and down slowly.

Step 3: Change the frequency of the transverse wave. Continue moving the end of the slinky up and down, but more quickly. The frequency of the wave will increase (how quickly the wave moves).

Step 4: Change the amplitude of the wave. Continue moving the slinky up and down, but this time move your hand higher and lower. This has changed the amplitude of the wave (how high it goes).

Step 5: Draw a transverse wave in the box on the next page.

Step 6: Return to your partner

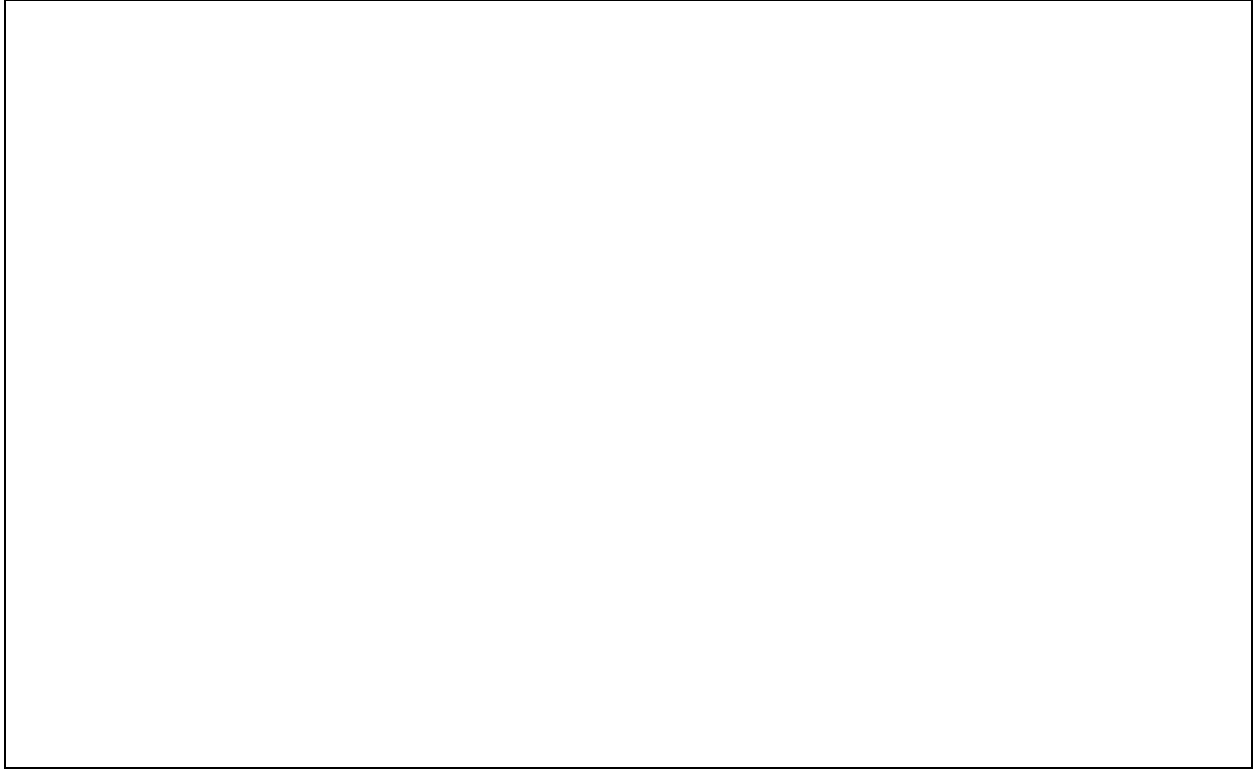
Step 7: Create a longitudinal wave with the slinky. Have one person hold their end of the slinky still. Have the other person begin to move the other end of the slinky pushing towards the person holding the other end of the slinky and pulling it back, moving slowly.

Step 8: Change the frequency of the wave. Continue pushing and pulling the slinky but move it faster than before. This has changed the frequency of the wave.

Step 9: Draw a longitudinal wave in box 3 on the next page.



## Box 2. Transverse Slinky Wave Drawings



### Transverse waves

Transverse waves move upwards as they move forward. You can easily see this kind of wave when you toss a rock into the lake and watch the ripples move across the top of the water. This is also the type of wave that you see when you watch the tide come in or go out.

### Box 3. Longitudinal Slinky Wave Drawings



#### Longitudinal waves (pressure)

Longitudinal waves move forward or backwards but do not move up and down. Sound waves are the most common kind of longitudinal wave. We looked at sound waves when we recorded the voice of the drum.



Figure 4. Longitudinal waves

## **Part 3: Chladni Plates**

### Objectives

1. Review how to use a Chladni plate and what it is
2. Use the Chladni plate to create figures and draw them

### Materials

- 1 Chladni plate\*
- 1 violin bow
- 1 drumstick
- Sand or salt

### What to do, step by step:

Step 1: Pour about one teaspoon of sand or salt on top of the plate and spread it evenly over the plate.

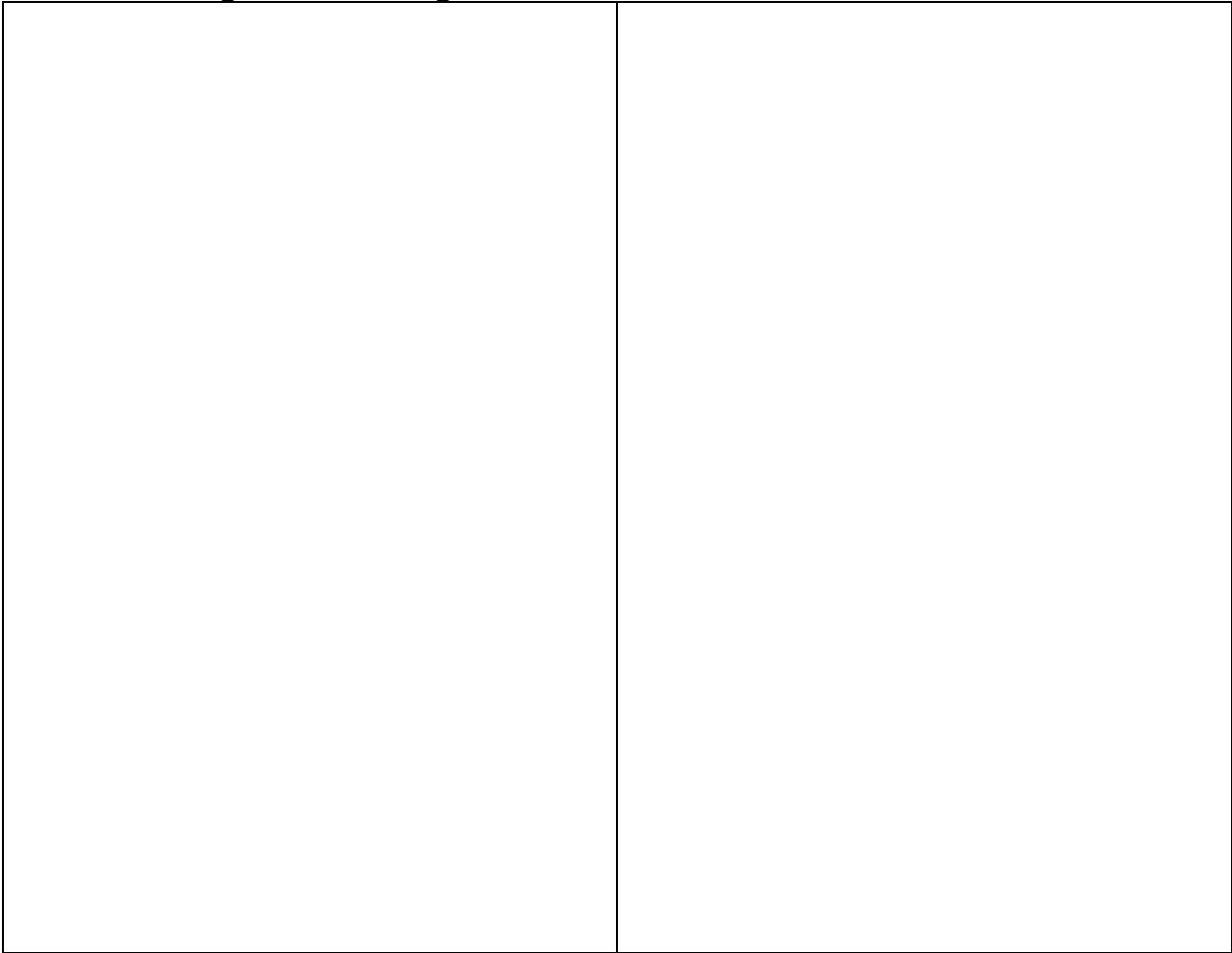
Step 2: Run the violin bow up and down the edge of the metal plate. The sand will begin to bounce around on the plate. Continue to do this until you can see the shape.

Step 3: Using the drumstick begin to tap the side of the metal plate. Continue to tap until you can see a shape.

Step 5: In the box on the next page draw two of the Chladni figures that you created.

\*If you do not have access to a Chladni plate, you can find videos to demonstrate the visual patterns of audio frequencies on youtube

Box 4. Drawing of Chladni figures



## Contributor and Reference List

2018 and 2019 Content Development Team (lesson creators):

1. Florence Blackett, Department of Applied Human Nutrition, Mount Saint Vincent University
2. Iain Caldwell, Department of Education, Mount Saint Vincent University
3. Kwaku Agyare, Department of Biology, Mount Saint Vincent University

Knowledge Keepers, Elders and/or Indigenous people who contributed to Indigenous Knowledge in this lesson:

1. Thomas Christmas, Elder, Eskasoni First Nation, Nova Scotia
2. Velvet Paul, Education Director Sipekne'katik First Nation

All unreferenced stories, Mi'kmaq words, or Indigenous knowledge was provided by the Elders/Knowledge Keepers listed above.

Individuals who contributed to the Western Science in this lesson:

1. Katherine Darvish, PhD., Department of Chemistry and Physics, Mount Saint Vincent University
2. Cherif Matta, PhD. Department of Chemistry & Physics, Mount Saint Vincent University

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