

What Inspires a Composer

For 5th-8th grades







Lesson 1 — *Music in Nature: Exploring Pitch & Intonation Through the Science of Vibration*

Objective

Students will understand how vibration relates to the science of sound as they listen to a piece of music. Students will explore how the vibrations from a string instrument create various pitches and develop intonation. Students will relate the physics of sound and instrument vibrations to expressive qualities in a piece of music.

Suggested Materials

- Audio recordings
 - CAROLINE MALLONEE “Pure Note” from *Whistler Waves* 
 - NASA Whistler Waves excerpt 
 - Pure Note Whistlers example 
 - “How do instruments make music?” video 
- Vocabulary list (provided)

New York State Arts Standards

MU:Re7.1.5a-8a
MU:Re7.2.5a-8a
MU:Re8.1.5a-8a

New York State English Language Arts & Literacy Standards

Speaking & Listening, Standards 1-3
Language, Standards 1, 3, & 6

New York State Science Standards

P-PS4-1
1-PS4-1
MS-PS4-1

Procedure

- 1) Introduce the natural phenomenon of whistler waves to students. A **whistler** is an audible low frequency wave in the atmosphere generated from a lightning strike. A whistler is detected as a gliding high-to-low frequency sound repeated at regular intervals of several seconds, or a descending musical tone. There are four types of whistler waves. A **pure note whistler** results from higher frequencies arriving to the atmosphere first, followed by lower ones, resulting in a clear whistling sound.
- 2) Have students listen to the NASA whistler waves excerpt.

Lesson 1 — *Music in Nature* (continued)

- 3) Review the vocabulary list with students and explain each scientific concept and how it relates to music:

Pitch is the quality of sound, or the degree of highness or lowness, based on the rate of vibrations producing it. **Intonation** is the variation of pitch. Use the following video clip to reinforce the concept of sound: 🎧 (Time Stamp: 0:00-0:30)

Frequency is the speed of **vibration** which determines the pitch of the sound. Explain to students that higher frequencies produce higher sounds, while lower frequencies result in a lower pitch, or sound. Use the following video clip to reinforce the concept of frequency: 🎧 (Time Stamp: 0:30-1:04)

Pitch is also affected by the **wavelength** of sound- the size of the sound wave itself. Lower notes have longer wavelengths (waves are more spread out), while higher notes have shorter wavelengths (waves are closer together). That is why pressing down on the strings of a cello will raise the pitch- the player is shortening the length of the string that is free to vibrate. Use the following video clip to reinforce this concept: 🎧 (Time Stamp: 1:05-end)

- 4) Caroline Mallonee is an award-winning composer and performer based in Buffalo. Her concerto, *Whistler Waves*, was written for BPO cellist Feng Hew. The composer wanted to create a piece that sounded like the natural phenomenon of whistler waves. Each of the four movements in the concerto correspond to a different type of whistler wave.
- 5) Have students listen to "Pure Note" from *Whistler Waves* and focus on the similarities and differences they hear in the music compared to the natural whistler wave sound. How is the solo cello part imitating a whistler wave? What musical techniques are used to create the whistler effect? Have students raise their hand or notate the time stamp in the recording during the parts where they hear the whistler wave sound imitated.

Lesson 1 — *Music in Nature* (continued)

Vocabulary List

Vibration:

movement that produces sound

Frequency:

the speed of vibration that determines pitch. Frequency is measured as the number of wave cycles that occur in one second. In music, frequency is measured as the number of vibrations in the air that reach our eardrums every second.

Wavelength:

the size of a sound wave, or the distance a wave travels before the next wave begins. Changing the length of a sound wave changes the frequency, producing a new pitch.

Pitch:

the quality of sound, or the degree of highness or lowness, based on the rate of vibrations producing it

Intonation:

the variation of pitch

Whistler:

an audible low frequency wave in the atmosphere generated from a lightning strike. A whistler is detected as a gliding high-to-low frequency sound repeated at regular intervals of several seconds, or a descending a musical tone.

Pure Note Whistler:

a type of whistler wave that results from higher frequencies arriving to the atmosphere first, followed by lower ones, producing a clear whistling sound