



ROCK AND ROLL AND THE SCIENCE OF SOUND

GET READY TO ROCK! A PRE-VISIT GUIDE FOR TEACHERS

TARGET GRADE LEVEL:

Grades 5-8

CLASS DESCRIPTION:

We typically think of music as an art form, but every note we hear can be understood in relation to the laws of science. This class examines the basic acoustic principles in the sounds of rock and roll by investigating how all sounds are created by vibrations, how sound travels to our ears through moving air molecules, and how sounds can be represented in a graph by using an oscilloscope or a computer. Students will learn how the musical notes of instruments are determined by frequency and amplitude and how the shape of a waveform determines an instrument's timbre. Musical examples showcase Rock and Roll Hall of Fame Inductees and illustrate how we perceive the various elements of sound. The class concludes with a live demonstration of digital audio software in which audience volunteers get to record and manipulate their own voices.

OBJECTIVES:

As a result of this class, students will be able to

1. Distinguish between the concepts of sound and noise, and explain basic physical properties of sound.
2. Give examples of the above drawn from musical recordings and technologies.
3. Identify physical properties of sound waves that determine musical characteristics, such as volume, pitch, and timbre.

RELATED OHIO ACADEMIC CONTENT STANDARDS:

SCIENCE

Physical Sciences

- 5 Benchmark A, B, E, F
- 6-8 Benchmark B, D

Science and Technology

- 5 Benchmark A
- 6-8 Benchmark A

Scientific Inquiry

- 5 Benchmark B
- 6-8 Benchmark B

Scientific Ways of Knowing

- 5 Benchmark A
- 6-8 Benchmark C

FINE ARTS—MUSIC

Historical, Cultural and Social Contexts

- 5-8 Benchmark C

Analyzing and Responding

- 5-8 Benchmark A, C

Valuing Music/Aesthetic Reflection

- 5-8 Benchmark B, C

Connections, Relationships and Applications

- 5-8 Benchmarks A, B, C, D

MATHEMATICS

Patterns, Functions, and Algebra

- 5-7 Benchmark B, F

Data Analysis and Probability

- 5-7 Benchmark A, B

TECHNOLOGY

Nature of Technology

- 5 Benchmark A, C
- 6-8 Benchmark A, C

Technology and Society Interaction

- 5 Benchmark E
- 6-8 Benchmark E

ENGLISH LANGUAGE ARTS

Communication: Oral and Visual

- 5-7 Benchmark A
- 8 Benchmark A



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SUGGESTED PREPARATION ACTIVITY:

OBSERVING SOUND

Create stations and group students to experiment with sound in your classroom.

Examples:

- A) Describe the sounds of rubbing the dampened rim of a crystal glass. Do the same procedure when the glass is submerged in water. What happens?
- B) Observe what happens when rubber bands of varied widths and thicknesses are stretched across a box and plucked. Why do the resulting sounds differ?
- C) Record varied sounds (low, high, loud, quiet, etc.) using a tape recorder or computer software. What happens to the sounds when they are played back at faster or slower speeds? Why?

Have students also consider the ways we utilize technology to incorporate sound into our daily lives (street crossing signals, alarms, computer and fax signals, cell phone ringtones, background music, entertainment, etc.) Lead students in a discussion to consider why sound and music is used in daily life. What kinds of technology make it possible to use music as we do? How would our lives be different without these sounds and technologies?

EXAMPLES TO BE DISCUSSED IN CLASS:

NOTE: Preview all materials for appropriateness for your students.

James Taylor. "Carolina on My Mind." *James Taylor*, 1968.

Lou Reed. "Metal Machine Music, Pt. 1." *Metal Machine Music*, 1975.

Bill Haley and His Comets. "Rock Around the Clock." 1954.

The O'Jays. "For the Love of Money." *Ship Ahoy*, 1973.

Free, streaming videos of most performances can be found on www.youtube.com or blip.fm

Free, streaming audio tracks of most songs can be found on www.grooveshark.com or blip.fm



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GLOSSARY

Acoustics: The science or physics of auditory vibrations, including the study of the physical basis of music

Amplitude: The strength (or energy) of an oscillating, or vibrating, sound waveform that corresponds to the loudness of the sound

Aural: Related to the ear or the sense of hearing

Frequency: A measurement of how often a recurring vibration of a sound wave occurs in a measured amount of time, commonly calculated in the number of "cycles per second" (recorded in Hertz or Hz); corresponds to the pitch of the sound

Noise: Unwanted sound, or the addition of external factors to the stream of target information being received

Pitch: The element of music that describes the sound of notes from low to high; the aural perception of the frequency of sound waves

Sound: A sensation produced by vibrations

Timbre: The quality of sound that distinguishes it from other sounds of the same pitch and volume; also known as tone color

Volume: The element of music that describes the loudness or quietness of a sound; the aural perception of the amplitude of sound waves

Waveform: The contour, or shape, of a sound wave shown graphically to indicate amplitude and time

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