Physics Of Sound

Content Area: **Practical Arts**
Course(s): **Music Recording & Engineering**
Time Period: **Marking Period 1**
Length: **2-3 weeks**
Status: **Published**

Course Pacing Guide

Unit	MP	Weeks
Physics Of Sound	1	2-3
Logic Pro Introduction (Digital Audio Software)	1	2-3
Microphones and Recording	1	3-4
MIDI Recording/Editting	1	2-3
Multi Track Recording	2	2
Mutli tack Mix/Mastering	2	3-4
Foley Cinema Sound Production	2	3-4
Live Sound	2	2-3

Unit Overview

Overview of the Physics of Sound. An analysis of sound waves, sound motion and sound mediums.

Enduring Understandings

- Having a working knowledge of the properties of sound.
- Having an undertsanding of sound creation, shape, speed, and function.

Essential Questions

- What is sound?
- What are the different forms of sound waves?
- How do we receive/detect sound?
- How do we control/manipulate sound?

New Jersey Student Learning Standards (No CCS)

9-12.HS-PS1-1.1	Patterns.
9-12.HS-PS1-1.2	Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
9-12.HS-PS1-1.PS1.A	Structure and Properties of Matter
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

Amistad Integration

Large Group Discussion/Listening Analysis:

- Discuss the life and career of:
- Wondagurl
- DJ Jazzy Jeff
- DJ Kool Herc

LA.RI.11-12.10b	By the end of grade 12, read and comprehend literary nonfiction at grade level text-complexity or above.
SEL.PK-12.1.2	Recognize the impact of one's feelings and thoughts on one's own behavior

Holocaust/Genocide Education

Large Group Discussion/Listening Analysis:

- Discuss the life and career of famous Jewish american sound engineers/musicians:
- Elliott Scheiner
- Benny Goodman
- Adam Sandler

Interdisciplinary Connections

PFL.9.1.12.A.8	Analyze different forms of currency and how currency is used to exchange goods and services.

Technology Standards

List specific standards that are relevant
No general statements

TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.D.6	Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.
TECH.8.2.12.D.CS1	Apply the design process.

21st Century Themes/Careers

HPE.2.2.8.A.2	Demonstrate the use of refusal, negotiation, and assertiveness skills when responding to peer pressure, disagreements, or conflicts.
CAEP.9.2.12.C	Career Preparation
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Financial Literacy Integration

1. The State Board of Education shall require that a school district incorporate in each of the grades **1[**kindergarten**]** six**1** through eight financial literacy instruction to pupils enrolled in those grades. The purpose of the instruction shall be to provide **1[**elementary and**]1**middle school students with the basic financial literacy necessary for sound financial decision-making.

The instruction shall meet the requirements established by the State board and shall:

a. be appropriate to, and reflect the age and comprehension of, the students enrolled in the particular grade level; and

b. include content on budgeting, savings, credit, debt, insurance, investment, and other issues associated with personal financial responsibility as determined by the State board.

Instructional Strategies & Learning Activities

- **Physics of Sound**
- Instructional Activities:

- Large group discussions
- Physics Of Sound demonstrations - Sound wave patterns
- Partner activities - Sound decibels
- Sound Categories
    - Pitch – How hi or low the sound is in terms of frequency
    - Amplitude (volume) – How Loud or soft the sound is
    - Timbre (pronounced TAMBER) – Determines the sound quality or tone color of each sound.
- Sound Waves
    - Sound wave shape categories ***Determine the Timbre**
    - Simple sound wave forms:
        - Sine Wave – Pure wave form consisting of one frequency. Ex. A-440. This is the pitch A at 440 Hz.
        - Square Wave – A Sound wave consisting of only odd frequencies.
        - Triangle wave – A sound wave consisting of only even frequencies.
        - Saw tooth wave – A Sound wave consisting of all frequencies at once within a given pitch harmonic family. *Saucilator App.
    - Complex wave forms. Real life sounds are made up of different combinations of these simple sound wave forms. This determines the exact *Timbre*of each given musical instrument and sound for that matter. *Sound spectrum app. Logic recording demo.
    - Sound wave components
        - Vibrations – Sound is vibration. Sound is not only heard, but therefore felt. *Tuning Fork Demo
        - Hz – Hertz – measurement of cycles of sound waves. Number of cycles per second.
            - The Human infant's Audible Frequency Range of hearing resides between 20Hz and 20,000 Hz.
            - The Human Adult's audible frequency range resides between 20Hz and 16,000 Hz.
            - The A Major scale in Hz
                - A - 440 Hz
                - B – 495 Hz
                - C# - 550
                - D – 586 Hz
                - E – 660 Hz
                - F# - 733 Hz
                - G# - 825 Hz
                - A – 880 Hz.
            - Harmonic Content
                - The lowest frequency of a given pitch is referred to as the Fundamental.
                - Partials, which are higher than the fundamental are referred to as *upper partials*or *overtones*.
                - Overtone frequencies that are whole number multiples of the fundamental are referred to as *Harmonics*or *octaves*.
                - If we start with A-440 and move a multiple up to A-880, A-880 is the second harmonic of A-440. A-1760 is the third harmonic and so on. *Trumpet/Keyboard Demo
            - Wave Length – Length of I cycle – Average human voice sound wave is approx. 1 meter at standard room temperature.
            - Frequency – ***Pitch of a sound signal – Determined by Hertz**. The higher the hertz, the higher the pitch.
            - Amplitude – The height of a compression of a sound wave. This determines how "loud" the sound wave is.

        - Decibels – measure sound in terms of sound pressure. SPL – Sound Pressure level.
        - Estimated chart of decibels:
            - 20 Db – Studio speech
            - 50 Db – Office area. Ave daytime indoor noise.
            - 80 Db – Pneumatic Drill
            - 120 Db – Jet take off.
            - 130/140 Db - Siren
    - Calculations
        - Frequency = Speed/Wave length
        - Speed = Frequency * wave length.
        - Ave. Speed of sound is 343 meters per second.
        - Ave. Sound wave length of the human voice is approximately 1 meter.
- Types of Sound Waves
    - Traveling Sound Waves
        - Compression – Positive arc – ***Determine the amplitude**
        - Rarefaction – negative arc-
        - Standing Sound Waves – Waves in a tube i.e. brass/woodwind *PVC Pipe demo
            - Node – Point of minimal vibrations
            - Antinode – Point of maximum vibrations
            - Fundamental – longest wavelength within a standing wave.
            - Overtone (even Harmonic)– Multiples of the Fundamental (higher octaves)
            - Harmonic (odd harmonic)– Pitches based on the fundamental – higher.
        - Transverse Sound Waves – Waves resounding from a plucked string i.e. stringed instrument
- Shapes of Sound Waves

- Sound Wave – motion patterns
    - Sound Diffusion – The displacement of sound in a given environment.
    - Sound Reflection – Sound bounces off a surface at the exact opposite angle of contact.
    - Sound Diffraction – Sound wraps around an obstacle.
    - Sound Refraction – Sound responding to different surfaces (mediums)
    - Constructive wave patterns
    - Destructive Wave patterns *Phase cancellation demonstration
- Sound types
    - Definite Pitch – melodic pitch – a sound that can be sung.
    - Indefinite Pitch – non-melodic pitch – Sound that cannot be matched to a musical pitch.
- Sound Stages (Envelope):
    - Attack – Beginning of a sound
    - Sustain – nature of the sound (long/short)
    - Decay – end of a sound
- Digital Sound – A/D Converter (Sound card – Interface): Converts analog audio to digital audio In other words, it adapts sound into a digital environment.
    - Bit Depth: level of clarity or accuracy that sound is transferred. The bit depth is the size of the audio sample in binary digits. Standard Bit Depths are 24,32 and 64.
    - Sample Rate: Rate or number of samples of a given sound that are extracted and used in reproducing the sound as digital. This is measured by the second in units of KHz. Standard sample rates:
        - 44.1 kHz – CD/audio
        - 96 kHz – DVD
        - 192 kHz – High end audio

- Quantization – Process of applying a sound sample to a Bit Depth.
- Audio – A sound file. An audio file is made up of a digital sound wave. It contains sound.
- MIDI – Musical Instrument Digital Interface. MIDI is a protocol that allows MIDI instruments to communicate with other MIDI instruments. A MIDI file contains no real sound. Rather it contains musical data. This data is sent via – a MIDI interface to a MIDI instrument bank where it is received and then "pronounced".

Differentiated Instruction

Examples may include:

- Curriculum Map
- Inquiry/Problem-Based Learning
- Learning preferences integration (visual, auditory, kinesthetic)
- Sentence & Discussion Stems
- Tiered Learning Targets
- Self-Directed Learning
- Debate
- LMS use
- Student Data Inventories
- Mastery Learning (feedback toward goal)
- Rubrics
- Learning Menus
- Learning Through Workstations
- Concept Attainment
- Mentoring
- Student Interest & Inventory Data

Formative Assessments

- Daily Teacher Observation of student feedback.
- Weekly check point written assessments.

Summative Assessment

Written Test: Physics Of Sound

Benchmark Assessments

Benchmark - 90% of students in the class will achieve a score of 93 or higher on the summative asessment (Written Test - Physics Of Sound)

Alternate Assessments

- Oral response to questions in review of material.
- More time alloted for written assignments/asessments.
- Take Home projects/reviews/asessments.

Resources & Technology

Digital Audio Workstation - Logic Pro X.

BOE Approved Texts

BOE Approved Texts N/A

Closure

Such as:

- Low-Stakes Quizzes - Give a short quiz using technologies like Kahoot or a Google form.
- Have students write down three quiz questions (to ask at the beginning of the next class).
- Question Stems - Have students write questions about the lesson on cards, using question stems framed around Bloom's Taxonomy. Have students exchange cards and answer the question they have acquired.
- Kids answer the following prompts: "What takeaways from the lesson will be important to know three years from now? Why?
- Ask a question. Give students ten seconds to confer with peers before you call on a random student to answer. Repeat.
- Have kids orally describe a concept, procedure, or skill in terms so simple that a child in first grade would get it.

- Direct kids to raise their hands if they can answer your questions. Classmates agree (thumbs up) or disagree (thumbs down) with the response.
- Have kids create a cheat sheet of information that would be useful for a quiz on the day's topic.
- Kids write notes to peers describing what they learned from them during class discussions.
- Ask students to summarize the main idea in under 60 seconds to another student acting as a well-known personality who works in your discipline. After summarizing, students should identify why the famous person might find the idea significant.
- Have students complete the following sentence: "The [concept, skill, word] is like _____ because _____."

ELL

Such as:

- Alternate Responses
- Advance Notes
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- E-Dictionaires

Special Education

List is not inclusive but may include examples such as:

- Shorten assignments to focus on mastery of key concepts.
- Shorten spelling tests to focus on mastering the most functional words.
- Substitute alternatives for written assignments (clay models, posters, panoramas, collections, etc.)
- Specify and list exactly what the student will need to learn to pass.
- Evaluate the classroom structure against the student’s needs (flexible structure, firm limits, etc.).
- Keep workspaces clear of unrelated materials.
- Keep the classroom quiet during intense learning times.
- Reduce visual distractions in the classroom (mobiles, etc.).
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Use a study carrel. (Provide extras so that the student is not singled out.)
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.

- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Provide a vocabulary list with definitions.
- Permit as much time as needed to finish tests.
- Allow tests to be taken in a room with few distractions (e.g., the library).
- Have test materials read to the student, and allow oral responses.
- Divide tests into small sections of similar questions or problems.
- Allow the student to complete an independent project as an alternative test.
- Give progress reports instead of grades.
- Grade spelling separately from content.
- Allow take-home or open-book tests.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.
- Mark the correct answers rather than the incorrect ones.
- Permit a student to rework missed problems for a better grade.
- Average grades out when assignments are reworked, or grade on corrected work.
- Use a pass-fail or an alternative grading system when the student is assessed on his or her own growth.

504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

At Risk

Examples may include:

- Use of mnemonics
- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Use of a study carrel
- Assistance in maintaining uncluttered space
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Peer or scribe note-taking
- Lab and math sheets with highlighted instructions
- Graph paper to assist in organizing or lining up math problems
- Use of manipulatives
- No penalty for spelling errors or sloppy handwriting
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects
- Preview test procedures
- Film or video supplements in place of reading text
- Pass/no pass option
- Cue/model expected behavior
- Use de-escalating strategies
- Use peer supports and mentoring
- Have parent sign homework/behavior chart
- Chart progress and maintain data

Gifted and Talented

Focus on effort and practice

Offer the Most Difficult First

Offer choice

Speak to Student Interests

Allow G/T students to work together

Encourage risk taking