Tuning Fork Interference Teacher's Notes

Main Topic	Sound
Subtopic	Interference
Learning Level	High
Technology Level	High
Activity Type	Student

Description: Observe the sound when two tuning forks are struck simultaneously, resulting in beats or dissonance. Uses Audioscope software.

Required Equipment	Tuning fork set 255 Hz and 256 Hz, Set of 8 Tuning Forks (1), Audioscope software, computer with microphone
Optional Equipment	

Educational Objectives

- Understand that two sound waves can interact, or interfere with each other.
- Hear how two sounds with slightly different frequencies interfere with each other to form "beats."

Concept Overview

Two waves, when traveling through the same medium, will superimpose upon one another, causing *interference*. In the case of sound, the two sounds will combine to form a single sound. This lab asks students to combine the sounds from two tuning forks (which each produces a simple sine wave vibration) and observe the results.

First, they will use two tuning forks whose frequencies only differ by one vibration per second. Individually, these two sounds are probably indistinguishable. Played together, these two frequencies will combine to result in a phenomenon called *beats*. Beats result from the *constructive and destructive interference* of the two waves. As illustrated below, the closeness of their frequencies leads to alternating regions of constructive interference (resulting in a loud sound) and destructive interference (resulting in a soft sound or silence). The observer hears a pulsing sound. The frequency of the pulses is equal to the difference in the frequencies of the separate sounds.

When the difference in the frequencies exceeds about seven Hz, most humans can detect that two sounds are being played. The ratio of frequencies for more grossly different sounds can determine whether the combined sound seems pleasant (consonant) or unpleasant (dissonant).

Audioscope software provides a unique opportunity to see the waveforms and frequencies that make up a complex sound.

Lab Tips

Create nearly-matched tuning forks with a pair of identical tuning forks by adding a lump of clay to one tine of one fork. This will lower its frequency slightly and make beats possible when the pair is struck simultaneously.

Encourage students to explore the different functions of Audioscope, or enhance the lab with a demonstration that continues with Audioscope and more different sounds. Clear, loud beats (such as those made using resonance boxes) are especially interesting in the Waveform display.

Tuning Fork Interference

Name: _____

Class: _____

Goal:

Observe the sounds made by two tuning forks struck simultaneously.

Materials:

Tuning fork set 255 Hz and 256 Hz, One additional tuning fork, Audioscope software, computer with microphone

Procedure:

1. Strike one tuning fork on a wood block or the heel of your shoe. Hold the stem of the tuning fork gently against the table. Listen, and then stop the vibration. Strike the other tuning fork in the same way. Do the two tuning forks sound the same or different? _____
2. Strike the two tuning forks together, holding both gently against the table. Listen for at least ten seconds. Describe what you hear, and how it differs from the sound of a single tuning fork.

3. Choose a tuning fork with a frequency whose frequency is at least ten hertz higher or lower than 256 Hz. Repeat the experiment with two tuning forks, struck simultaneously. Describe what you hear, and how it differs from the sound of two barely different tuning forks.

4. Using a computer with a microphone, launch Audioscope software. Set the display to "Spectrogram" and test the microphone with the 256Hz tuning fork. Adjust the display so that the frequency is as high on the horizontal axis as possible.
5. Repeat the experiment in #2, with the two similar tuning forks. Describe what you observe on the Spectrogram display. Does this match your observation in #2?

6. Repeat the experiment in #3, with the two different tuning forks. Describe what you observe on the Spectrogram display. Does this match your observation in #3?