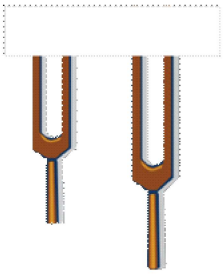
C. Tuning Forks Lab

Purpose: How can we use tuning forks to investigate the different properties of sound?

Introduction: A tuning fork is an acoustic resonator in the form of a two-pronged fork with the prongs formed from a U-shaped bar of elastic metal. It resonates at a specific constant pitch when set vibrating by striking it against a surface or with an object, and emits a pure musical tone once the high overtones fade out. A tuning fork produces a tone composed mainly of a single frequency; and it's pitch depends on the length and mass of the two prongs. Tuning forks are traditional sources of standard pitch for tuning musical instruments.

Materials (per group)**:**
2 tuning forks with matching frequencies
1 tuning fork with a different frequency
use your rubber sole (or a rubber mallet)
as a striking point



Procedure and Observations:
Take turns performing each of the tests below and record your observations. Gently strike the tuning forks against the sole of your shoe (or a rubber mallet) or the back of your elbow or hand with just enough force to start them vibrating.

1. Hearing Sound Vibrations: Strike the prongs of one tuning fork and then hold the fork close to your ear. What do you hear?

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_____

What happens when you touch the prongs of the fork?

_____

Why?_____

_____

2. Intensity of Sound Vibrations: Strike the prongs of one tuning fork gently and then hold the fork close to your ear. Strike the same tuning fork a little harder and listen. How do the sounds differ?

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_____

Why? _____

_____

3. Frequencies: Strike the prongs of two matching size tuning forks at the same time and listen to them both. What do you notice about the two sounds?

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Strike the prongs of two different size tuning forks at the same time and listen to them both. What do you notice about the two sounds?

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What do the numbers on the tuning forks mean?

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4. Doppler Effect: Strike a tuning fork and hold it at an arm's length in front of you. Rapidly bring the tuning fork toward your ear then away again. How does the pitch of the sound change as the tuning fork approaches your ear?

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_____

How does the pitch of the sound change as the tuning fork is moved away from your ear?

_____

5. Resonance: Strike a tuning fork and bring it within a few centimeters of the other tuning fork with the same frequency. Then bring the second tuning fork near your ear and listen closely.

What do you hear?

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_____

Explain why this happens.

_____

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Repeat step 5 with two tuning forks having different frequencies. How are the results different?

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6. Interference: Strike a tuning fork and bring one of the prongs to within 2 or 3 cm of your ear.

Slowing rotate the tuning fork completely. Describe any change in the loudness of the sound:

_____

As you are rotating the tuning fork, when do you think constructive interference occurs?

_____

As you are rotating the tuning fork, when do you think destructive interference occurs?

_____

Questions:

1. Did the loudness of the sounds change in some tests? If so, give examples and explain why the loudness changed.

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_____

2. Did the pitch of the sounds change in some tests? If so, give examples and explain why the pitch changed.

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3. How does one vibrating object make another object vibrate when they're not touching? What is true of both objects' vibrations when this happens?

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4. How does the Doppler Effect explain the change in pitch of a moving source of sound?

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Instructor's Guide
(Tuning Forks)

Time: 30-40 minutes

Equipment and Materials: Per group:

Items	Number	Comment
Tuning forks with matching frequencies	2	
Tuning fork with a different frequency	1	
Rubber mallet	1	optional

Ideas/ Information

1. When using a tuning fork to produce a pure tone, it is important to strike the tuning fork softly. Use a soft rubber mallet, the rubber heel of a shoe, or the fleshy part of the hand. Students should not strike hard objects like the tabletop, since that produces overtones and can damage the tuning fork.

2. Use tuning forks in the range of 256 to 512 Hz. Overtones are easy to produce on lower frequency tuning forks. Overtones on a 512 Hz tuning fork die out quickly.

3. Most tuning forks, when struck on a slightly harder object, produce the fundamental tone and one strong overtone.