SOUND EXPLORATION

Tuning Fork Interference

Strike a tuning fork with a rubber hammer or on the heel of your shoe. (Please do not strike the tuning fork on the edge of the table.) Place the vibrating tuning fork near your ear. Slowly rotate the vibrating tuning fork and note any variation in the intensity (loudness) of the sound. Make certain that you rotate the tuning fork through 360 degrees.

What do you hear?

Can you explain your observation?

Singing Tubes

Hold the large end of the plastic tube in one hand and swing the other end over your head. Be certain that no one is in the immediate area before you start swinging the tube. Start out swinging the tube slowly, and then speed up. You should hear higher and higher pitches as you swing the tube faster and faster.

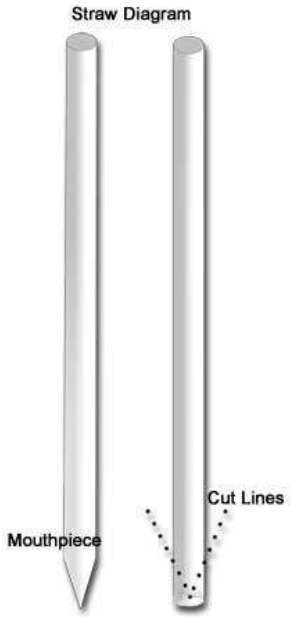
What do you think is producing the sounds you hear?

Why does increasing the rate of swings increase the pitch of the sound produced?

Can you produce any pitch you wish or are there only certain sounds that can be produced?

Now tear a sheet of paper into some small bits and place them on a tabletop. Hold the stationary end of the tube over the bits of paper while swinging the other end of the tube. Watch the paper fly!

The Last Straw!



Pinch together about ¾" of the end of a soda straw. This may be accomplished by pulling the end of the straw through clenched teeth. Using scissors, diagonally cut off the corners of the flattened end (see figure on left).

Place the flattened end in your mouth and blow gently. With a little practice, you will discover how to adjust your lips and air pressure to allow the straw's reeds to vibrate correctly. When the reeds vibrate, a sound will be produced. The device you have produced may be thought of as a "soda straw oboe," because like its namesake, it uses a double reed to produce sound.

Once you have produced a clear, loud sound, cut off successive pieces of the open end of the straw.

What happens to the pitch of the sound as the straw gets shorter?

How does a real oboe achieve changes in pitch?

Make another straw oboe, but this time cut small notches along the length of the straw. The effective length of this device is changed by covering and uncovering the holes. See if you can play a tune on this oboe!

Getting In The Groove

Cradle the cone in both hands as you lower the straight pin into the groove of a spinning record. The pin should drag behind the base of the cone, with only the weight of the cone holding it down.

What do you hear?

Describe the loudness and clarity of the sound.

Explain how sound is produced with this simple record player.

Music Box Marvel

If necessary, gently wind the music box mechanism. Listen to the tune.

Can you identify it? Can you even hear it?

Bring the mechanism in contact with a Styrofoam or paper cup, tabletop, window, blackboard, etc. Is the sound louder when it is in contact with a solid object?

Why do you suppose this is so?

Which object(s) makes the sound the loudest?

Which objects tend to be the least effective?

The Bells of St. Weber

Pick up the grate from a barbecue grill by the strings. If you don't have a clean grill grating, coat-hanger or metal utensils work too!

With the grate hanging by the strings, knock it against the side of a table. Describe the sound you hear.

How does the sound produced by the vibrating grate reach your ears?

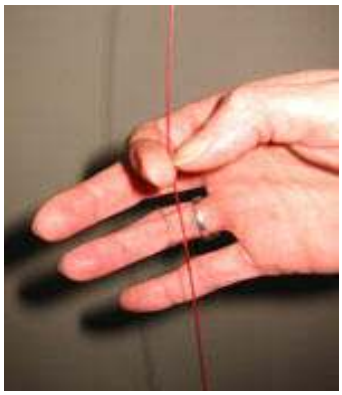
Now, with your index fingers, place the ends of the strings on the little flap of flesh that protrudes over the opening of each ear. Allowing the grate to hang freely from the strings, again swing the grate into the side of a table.

Describe the sound you hear with the strings pressed against your ears.

How is the sound reaching your ears?

How do you explain the difference in sound quality?

Talking Can Be A Drag!



Hold the pointed end of the plastic talking strip between the thumb and the index finger. Using your other hand, drag your thumbnail along the ridges on the strip, moving from top to bottom. Do you hear anything?

If you didn't hear anything as you moved your thumbnail along the strip, hold the pointed end of the strip against the end of a plastic, paper or Styrofoam cup. What do you hear this time? Why was the sound louder when the cup was used?

Try using other materials (for example, a piece of paper, a windowpane, a blackboard, a balloon, your front teeth) to amplify the sound. List the amplifying materials you test and describe their effectiveness as amplifiers.

How do you suppose the strip "talks" as you drag your thumbnail across the ridges?

Can you think of any other device that produces sound in a similar manner?

Why might it be a bad idea to play the tape backwards?

The Diving Tuning Fork

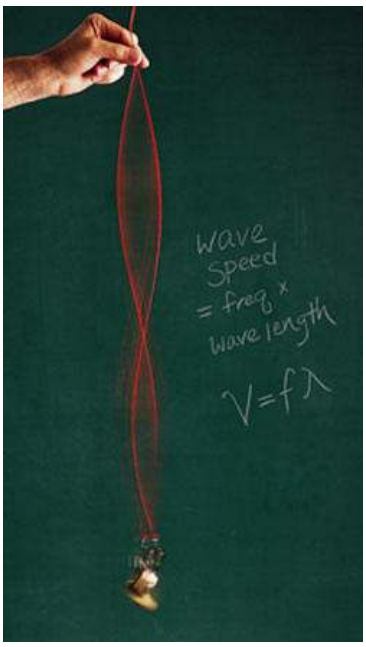
Strike the end of a tuning fork on a rubber pad or on the heel of your shoe. Barely touch the surface of a cup of water with the vibrating ends of the tuning fork.

What do you observe?

Do the vibrating ends of the tuning fork possess energy?

How do you know?

Nice Nodes



After activating motor by inserting the battery, hang the motor/battery holder assembly from string (see photograph).

Gently pinch the string at some point along its length. Slide your fingers up and down along the string until a standing wave is obtained. You will know you have a standing wave when the string is vibrating in segments. The moving portions of the string are called “anti-nodes.” The anti-nodes are separated by regions of no motion called “nodes.”

To change number of nodes (and anti-nodes) in your standing wave, simply vary the length of the string.

How do you think the standing wave pattern is produced?

Why do you think there's no motion at the nodes?

MacGyver "Softspeaker"

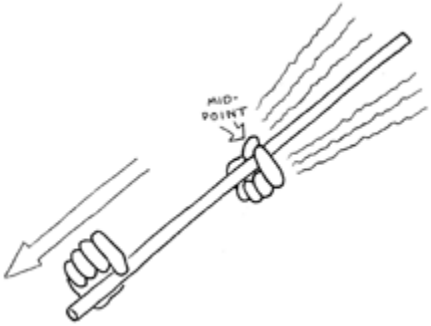
Examine the simple speaker. List its components.

Turn on the radio and find a strong station. Plug the mini-plug in the earphone jack of the radio. What do you hear coming from the speaker?

How do you think this simple speaker produces sound?

What factors do you think determine speaker volume?

Singing Rod

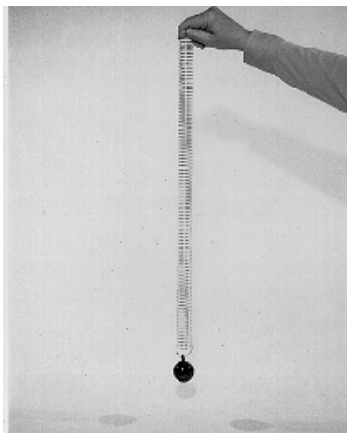


Hold the aluminum rod with your fingertips at its center. (Note: The center may be located by balancing the rod in your hand in the region between the thumb and index finger as in the figure above.)

Place some rosin on the tips of the thumb and index finger of the other hand. Grip one end of the rod between the rosin-covered fingertips and stroke the length of the rod between the end and center. With a little practice, you should be able to produce a piercing, high-pitched sound. If you are unable to get the rod to sing, tap the end of the rod with a mallet or hammer or tap it on a hard surface.

What did stroking or tapping the rod do to the rod? Grab the vibrating rod at a point off center. What happens? Why?

Mass on Spring



A. Gently lower the mass about 5 cm. below its equilibrium (stationary) position.

Describe the subsequent motion of the mass–spring system after the mass is released below the equilibrium position.

1. Where is the speed of the mass maximum?
2. Is the speed of the mass ever zero during its motion?
    a. If your answer is yes, then where in the motion is the speed zero?
    b. If your answer is no, then where in the motion does the mass change direction?
3. Describe the speed of the mass as it travels **toward** the equilibrium position.
4. Describe the speed of the mass as it travels **away** from the equilibrium position.

B. Run in a straight line (either forward and/or backward) that simulates the motion of the mass attached to the spring.

5. Describe your subsequent motion.
6. Where in your motion do you feel you had to exert the greatest force via your legs?

Noise Canceling Headphones

Put the headphones on with the on/off switch in the “off” position. What effect does wearing the headphones have?

While wearing the headphones, move the “on/off” switch to the “on” position. Wait for 5 seconds or so while the device samples the noise in the room. Describe what you hear when the active noise cancellation mechanism begins functioning.

Do the active noise cancellation headphones produce complete silence? If not, which sounds (high or low) seem to disappear when the device is activated?

How do you suppose this device works?