Metallophones have been used in Asia for thousands of years.

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A Sound Education: Heavy Metal

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Educational Outreach

Baylor College of Medicine

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A Sound Education: Heavy Metal

Reference

Metallophone. Wikipedia CC-BY-3.0. http://en.wikipedia.org/wiki/Metallophone

Image Reference

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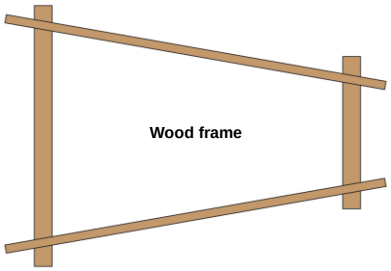
http://commons.wikimedia.org/wiki/File:Metallophone_indonesien.jpg

Key Words

sound, chime, frequency, hearing, metallophone, music, pitch, sound wave, vibration, xylophone

Make a Metallophone

A metallophone is similar to a xylophone. But it is made from tuned metal bars or pipes instead of wood.



1. Saw one 12-in. piece, one 8-in. piece, and two 16-in. pieces of wood from the long piece of wood.
2. Position the pieces as shown, then glue the pieces together with wood glue. Let the frame dry.

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Make a Metalaphone

Materials*

•6-in. or 8-in. all purpose flat steel mill file
- Crosscut wood saw
- Flat steel mill file
- Flexible tape measure
- Foam pipe insulation, 6-ft x 1/2-in. diameter
- Metal electrical conduit pipe, 6-ft x 1/2-in. diameter
- Pair of scissors
- Pencil
- Piece of wood, 5 ft x 1-in. x 2-in.
- Pipe cutter
- Sharp knife
- Tape measure
- Wood glue

*Materials listed above are for one sound station or demonstration. Adjust quantities for students working in teams.

Note 1: Foam pipe insulation must match size of the metal electrical conduit pipe.

Note 2: Pipe cutters usually cost about $10.00 at hardware stores. To see how to use a pipe cutter, view the demonstration video, “A Sound Education: Heavy Metal,” on BioEd Online (http://www.bioedonline.org/videos/lesson-demonstrations/waves-and-electromagnetic-radiation/sound/a-sound-education-heavy-metal/).

Setup

The two smaller pieces of wood will “lay” flat beneath the long pieces of wood.

Image Reference

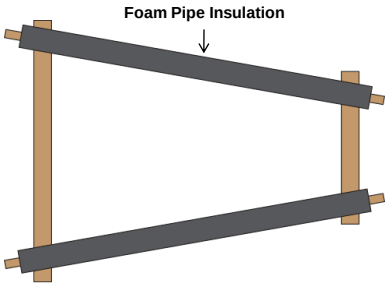
Illustration by G.L. Vogt, EdD.

Key Words

sound, frequency, hearing, metallophone, music, pitch, sound wave, vibration, xylophone

Add Foam Pipe Insulation

3. Using scissors, cut two 16-in. pieces from the long piece of foam pipe insulation.
4. The foam pipe insulation comes with a slit down the middle. Slip the foam insulation over the long wooden pieces of the frame, moving from left to right. Trim excess.



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Add Foam Pipe Insulation

Materials

•See slide 2, “Make a Metallophone.”

Optional

Alternatively you may use a sheet of cardboard for the base instead of wood.

Setup

Gluing the insulation foam to the surface of the wood is unnecessary. The interior surface of the insulation is sticky and will adhere to the wood.

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Key Words

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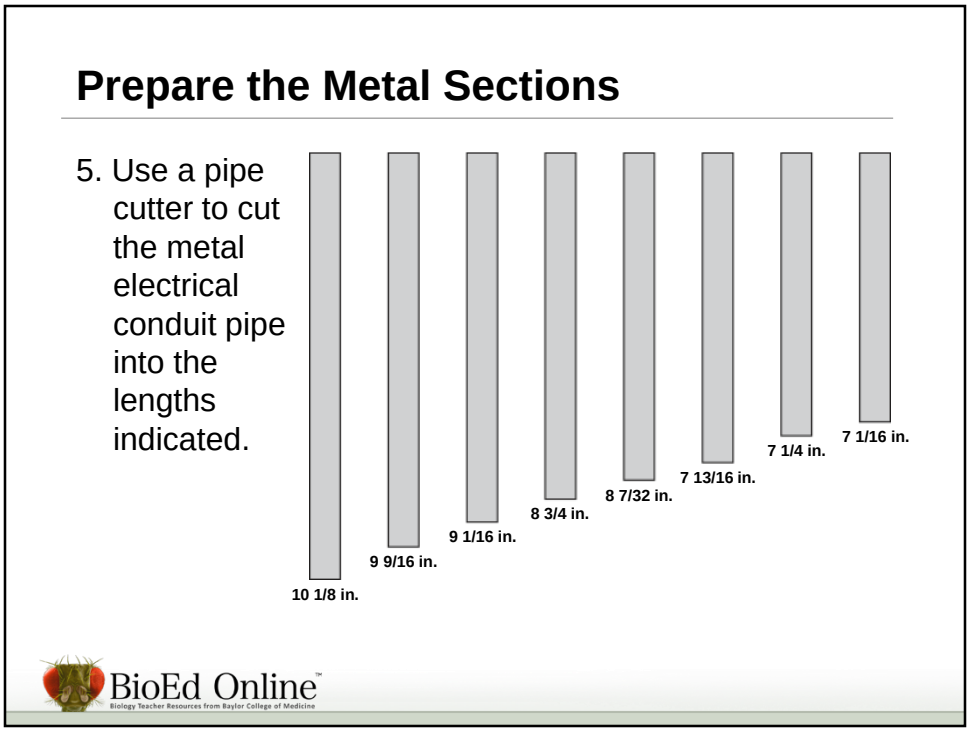

Prepare the Metal Sections

Materials

•See slide 2, “Make a Metallophone.”

Section Lengths

•Do: 7 1/16 in. = 7.0625

•Ti: 7 1/4 in. = 7.25

•La: 7 13/16 in. = 7.8125

•So: 8 7/32 in. = 8.21875

•Fa: 8 3/4 in. = 8.75

•Mi: 9 1/16 in. = 9.0625

•Re: 9 9/16 in. = 9.5625

•Do: 10 1/8 in. = 10.125

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Illustration by G.L. Vogt, EdD

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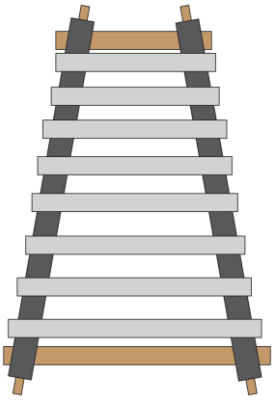
Assemble the Instrument

6. Place the metal pieces on top of the insulation, leaving about 1/2-in. between the pieces, as shown.
7. With the knife, carefully make notches into the insulation to hold the metal pieces in place.
8. Test each tube for sound. If one is out of tune, use a flat mill steel file to shorten it slightly to raise its pitch. If the pitch is too high, cut another tube of the correct length and, if possible, use the shorter piece for another note.



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Assemble the Instrument

Materials

•See slide 2, “Make a Metallophone.”

Setup

Place the metal electrical conduit pipe pieces approximately 1/2-in. apart from each other. The shortest piece of pipe to be placed across the frame is 7 1/6-in. in length. The longest piece of pipe to be placed across the frame is 10 1/2-in. in length.

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Illustration by G.L. Vogt, EdD

Key Words

sound, frequency, hearing, metallophone, music, pitch, sound wave, vibration, xylophone

How to Make Mallets

1. Purchase two wooden dowels with matching wooden balls (pre-drilled hole) from a craft shop.
2. Put a small dab of hot glue on one end of the wooden dowel and slide it into the hole in the wooden ball. Position the ball and wipe off any excess glue. Repeat steps above with the second dowel set. The mallets are ready when the glue is dry.
3. Obtain a wooden dowel with matching rubber stopper. Moisten the end of the dowel with water and slide it into the rubber stopper.

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How to Make Mallets

Materials*

•Hot glue gun with glue

- 2 wooden dowels, with matching one-hole wooden balls
- Wooden dowel with matching stopper or ball

*Materials listed are for one sound station or demonstration. Adjust quantities for students working in teams.

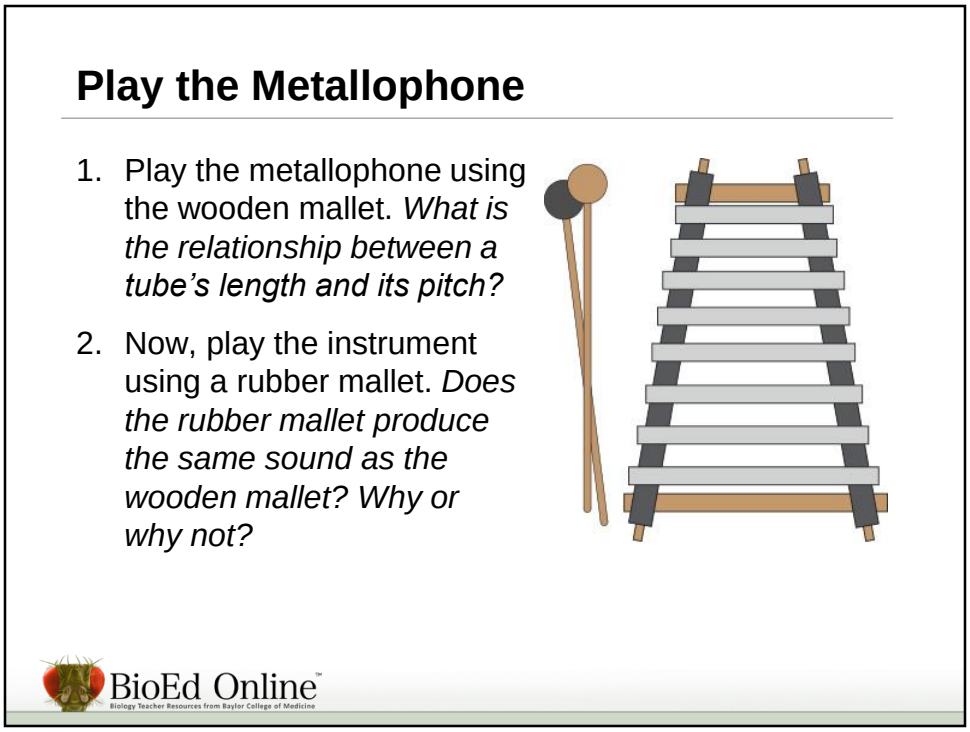
Optional

As an alternative to making the mallets, you can purchase inexpensive wooden (Glockenspiel mallets) and rubber mallets by the pair at music stores. Both types of mallets are available at the Guitar Center for about $6.00 per pair or lower. (http://www.guitarcenter.com/Orff-Mallets-Orff-Instruments.gc).

Image Reference

Illustration by G.L. Vogt, EdD

Key Words
sound, mallet, music



Play the Instrument

Materials

•See slides 2–5 for instructions on how to build the metallophone.

•See slide 6 for instructions on how to make mallets.

Questions to Ask

1. What is the relationship between a tube's length and its pitch? [The longer the tube, the lower the pitch.]

2. Does the rubber mallet produce the same sound as the wooden mallet? Why or why not?: [The rubber mallet is softer and produces a more mellow tone than the hard wooden mallet.]

Image Reference

Illustration by G.L. Vogt, EdD

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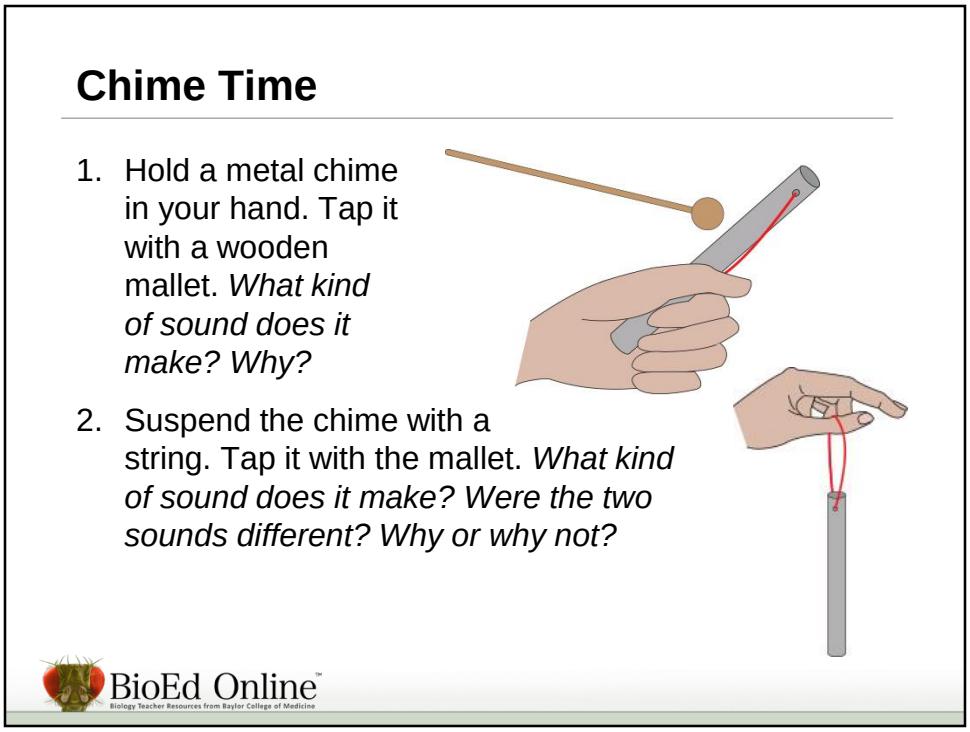


Chime Time

Materials*

•2 metal chimes, each of a different length

- 2 20-in. pieces of string (one per chime)
- Wooden mallet (See slide 6 for instructions on how to make the mallet and purchasing options.)

*Materials listed are for one sound station or demonstration. Adjust quantities for students working in teams.

Optional

As a demonstration, provide a set of wind chimes and play each chime one at a time.

Questions to Ask

1. What kind of sound does it make? Why? [It produces a dull sound because the sound vibrations are dampened by the hand.]

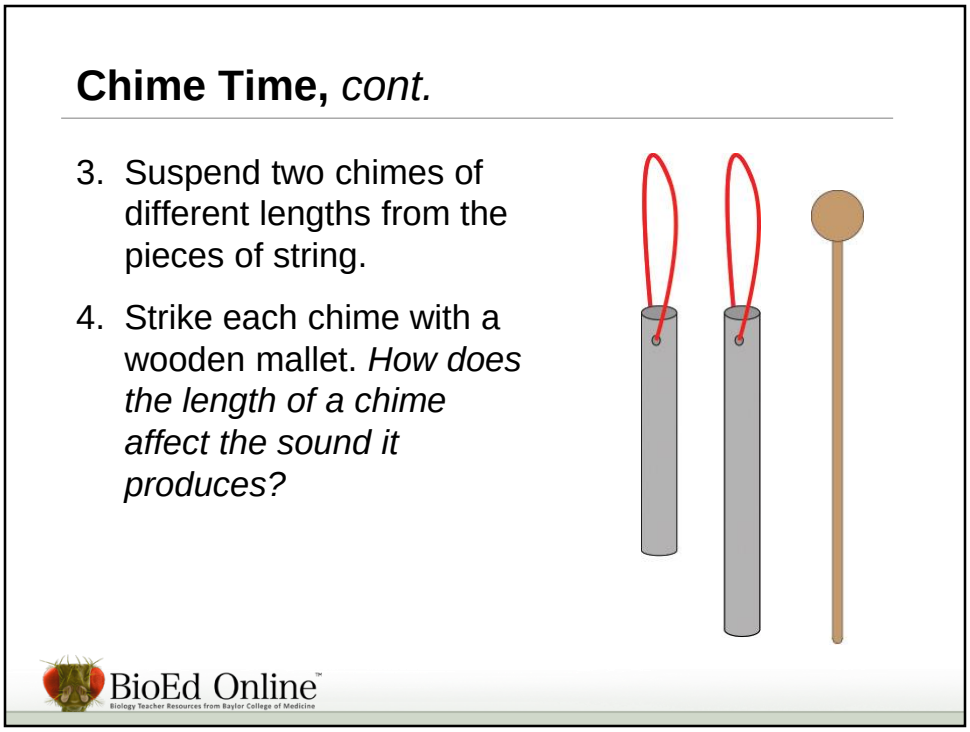
2. What kind of sound does it make? Were the two sounds different? Why or why not? [It produces a ringing sound. Yes. The suspended chime rings true because it is free to vibrate and sound a musical note.]

Image Reference

Illustration by G.L. Vogt, EdD

Key Words

sound, chime, frequency, hearing, music, pitch, sound wave, vibration



Chime Time, *cont.*

Materials

•See slide 8, “Chime Time.”

•See slide 6 for instructions on how to make a wooden mallet.

Questions to Ask

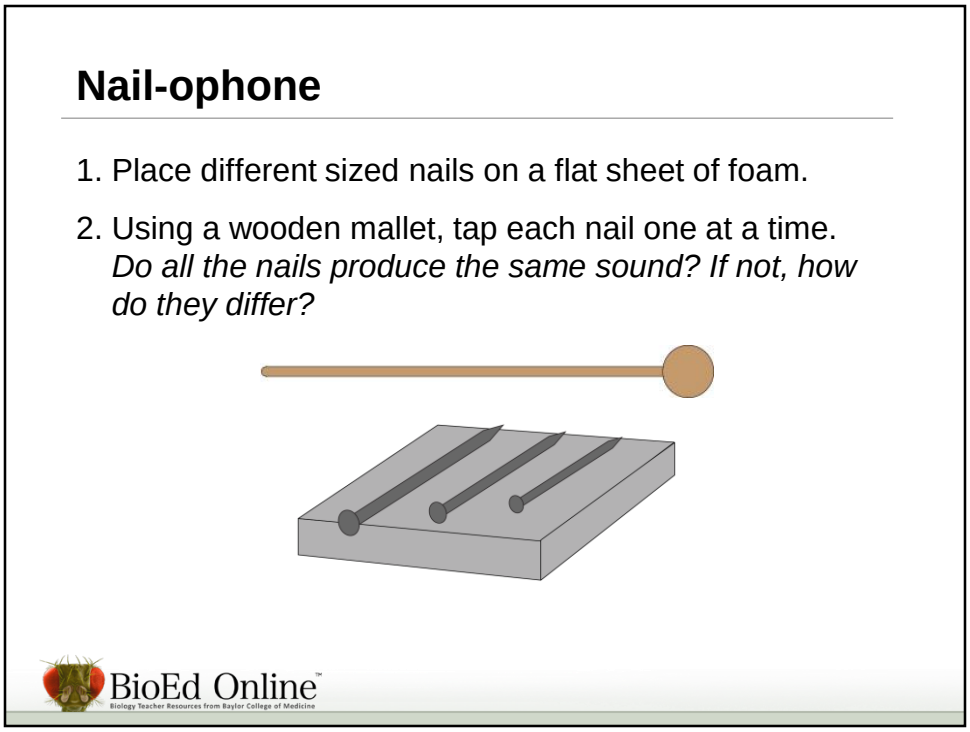
4. How does the length of a chime affect the sound it produces? [A longer tube produces a lower pitch.]

Image Reference

Illustration by G.L. Vogt, EdD

Key Words

sound, chime, frequency, hearing, music, pitch, sound wave, vibration



Nail-ophone

Materials*

•3 nails of different sizes and lengths

- Flat sheet of foam, 6-in. x 6-in. square (The thickness of the foam sheet doesn't matter. The idea is to lift the nails above the table surface so that the nails do not touch the table.)
- Wooden mallet (See slide 6 for instructions on how to make the mallet and purchasing options.)

*Materials listed are for one sound station or demonstration. Adjust quantities for students working in teams.

Questions to Ask

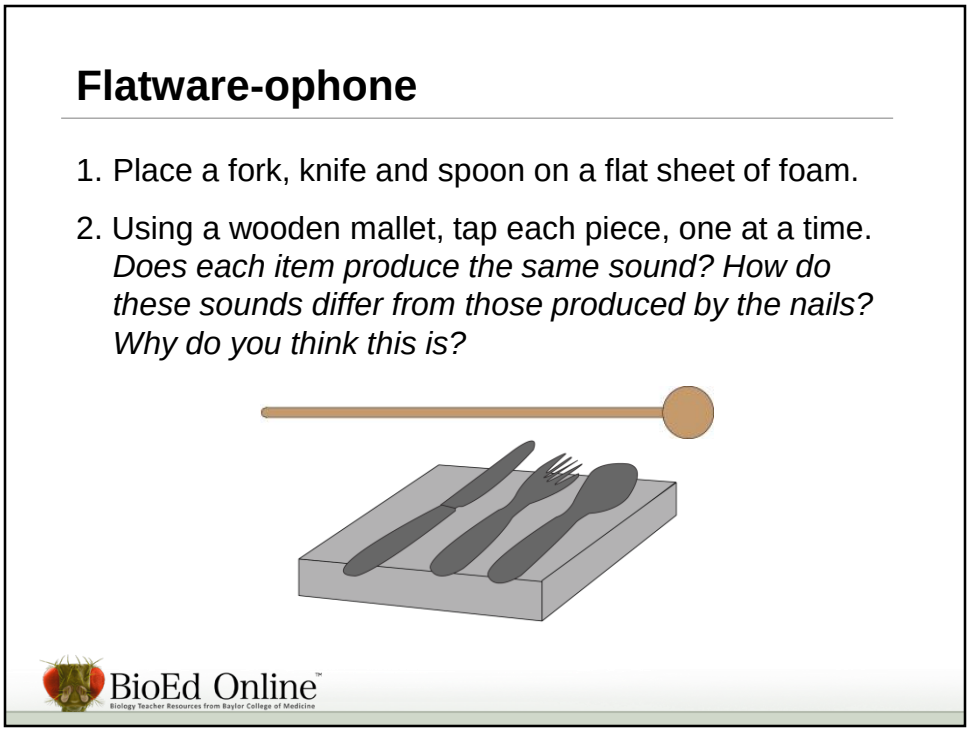
2. Do all the nails produce the same sound? If not, how do they differ? [The small nail has a higher pitch than the largest nail. The medium nail produces a sound in between the other two.]

Image Reference

Illustration by G.L. Vogt, EdD

Key Words

sound, frequency, hearing, pitch, sound wave, vibration



Flatware-ophone

Materials*

•Flat sheet of foam, 6-in. x 6-in. square (The thickness of the foam sheet doesn't matter. The idea is to lift the nails above the table surface so that the nails do not touch the table.)

- Knife, fork and spoon
- Wooden mallet (See slide 6 for instructions on how to make the mallet and purchasing options.)

*Materials listed are for one sound station or demonstration. Adjust quantities for students working in teams.

Optional

Test the sounds produced using solid metal flatware against sounds produced from composite metal flatware.

Questions to Ask

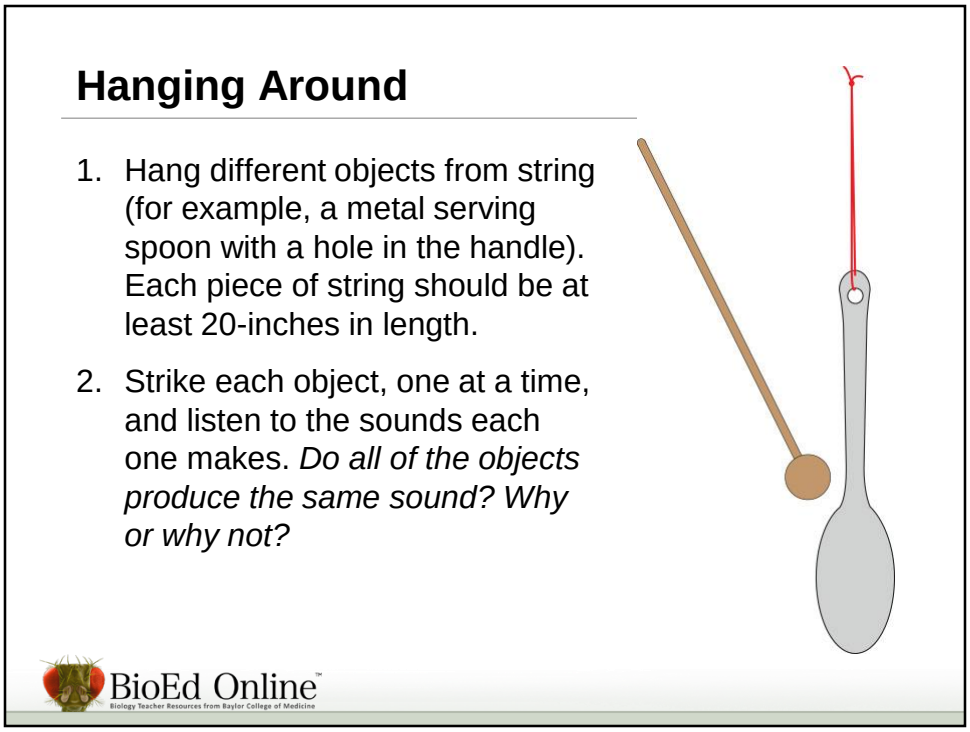
2. Does each item produce the same sound? How do these sounds differ from those produced by the nails? Why do you think this is? [Like the nails, each piece of flatware produces a musical note. The differences in sound are the result of each item's size and shape.]

Image Reference

Illustration by G.L. Vogt, EdD

Key Words

sound, frequency, hearing, pitch, sound wave, vibration



Hanging Around

Materials

•2 20-in pieces of string (more if suspending additional objects)

- 2 bare metal clothes hangers of different thicknesses (remove paper if wrapped)
- Large metal serving spoon with a hole in the handle
- Pencil
- Wooden mallet (See slide 6 for instructions on how to make the mallet and purchasing options.)

*Materials listed are for one sound station or demonstration. Adjust quantities for students working in teams.

Note: Use metal hangers without a paper covering. The paper will dampen the sound.

Questions to Ask

2. Do all of the objects produce the same sound? Why or why not? [No. Each object has unique properties and will produce its own sound.]

Image Reference

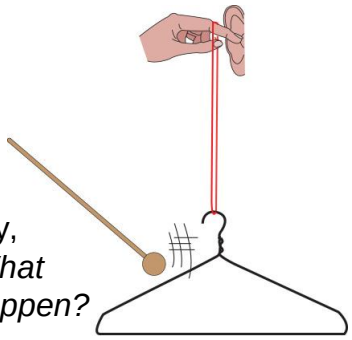
Illustration by G.L. Vogt, EdD

Key Words

sound, frequency, hearing, pitch, sound wave, vibration

Hanging Around, *cont.*

3. Suspend a coat hanger from a string loop, as shown. Loop the string around your index finger and press your finger to your ear.
4. While the hanger swings freely, tap it with a wooden mallet. *What do you hear? How can that happen?*
5. Try a different hanger made from thinner or thicker wire. *Does it produce a different sound? If so, why?*



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Hanging Around, *cont.*

Materials

•See slide 12, “Hanging Around.”

- See slide 6 for instructions on how to make the mallet and purchasing options.

Questions to Ask

4. What do you hear? How can that happen? [A sound is heard in the ear. The vibration of the hanger travels through the string, which in turn, vibrates the air around the ear. The air movement (which represents pressure differences) is perceived by the eardrum as sound.]

5. Does it produce a different sound? If so, why? [Yes. The sound produced depends upon the thickness of metal wire, which affects how the hanger vibrates.]

Image Reference

Illustration by G.L. Vogt, EdD

Key Words

sound, frequency, hearing, pitch, sound wave, vibration