

Grade Level(s): One and Two Lesson Title: Vibrating Things Sing

Focus: (Concept or skills to be emphasized) Vibrations, sound, pitch, listening, predicting



Objectives: See end of lesson for objectives and standards achieved.

Background Information:

Peter lassoed the wolf with a rope in the story of *Peter and the Wolf*. If Peter had plucked the rope, he would have noticed that it made a sound, similar to the sound of a string instrument being plucked. The pitch produced by the rope would have been very low. The length, tension, and thickness of a string affect the pitch of the note it produces. The longer, looser, and thicker a string is, the lower the note sounds. One of the reasons is because thick strings are heavier than thin strings, therefore the rate of vibration in a thick string is slower and it produces a lower sound. The length of a string also affects the pitch that it produces. The shorter a string is, the higher the note will be. This lesson will allow students to experiment with varying the lengths of strings (rubber bands will be used to model strings) to produce high and low sounds.

Activities (Procedures):

- 1. Read the story of *Peter and the Wolf*, as found in the Teacher's Section under The Verizon Literacy Resource Section with your class. Talk about how the wolf is captured (he is caught by a rope lasso). Ask the students what type of instruments in the orchestra have strings, which could look like thin ropes.
- 2. Play Peter's Theme, as found in either the WVSO CD ROM or the WVSO Audio CD Companion to your class. Ask students if they know what instruments are used to play Peter's Theme. Explain that Peter's theme is played by the violins, which are string instruments. Tell students there are many different types of string instruments, each with a unique appearance and sound. Direct students to the Strings in the Instrument section of the Orchestra Pit on the WVSO CD ROM and allow them time to look at and listen to each string instrument. If using the WVSO Audio CD Companion, listen to Peter's Theme while looking at a picture of the String family.
- 3. Talk about string instruments with students. Ask students to think about how string instruments produce sound. Tell students they will be performing an experiment that demonstrates how sound is created by string instruments.

- a. Arrange students into groups of 2-3. Assign the role of "*instrument*" to one student and the roles of "*musician*" and "*recorder/reporter*" to the other student(s). ss.1.2.1
- b. The Instrument: Provide each group with one rubber band. Ask the *instruments* to place their hands palm down on a desk or table with their thumbs facing inward and explain that they must keep their hands the same distance apart during the experiment (Note: Tell your students not to stretch the rubber bands so tightly that they will break). Tell the *musicians* to carefully stretch a rubber band between the base of the thumbs of the *instruments* (see figure). Remind them to be sure the *instruments* do not let the rubber band



The Instrument

slip off. Ask students what they think will happen when the rubber bands are plucked and to explain why they think this will happen. *sc.1.6.1*

- c. Direct the *musicians* to pluck the rubber band and then have the *recorder/reporter* write down what they heard and saw. As a whole group, discuss what happened. Ask students why they think this happened.
- d. Explain that the students will now have a chance to experiment with changing the pitch of their "instruments". Demonstrate pressing down at different points along the rubber band (see figure). Explain that each group will have the opportunity to experiment with pressing on the rubber bands after they have made a prediction about how this might change the sound produced when the rubber band is plucked. Ask each group to discuss what will happen and have the *recorder/reporter* write their predictions. Tell the *recorder/reporter* from each group to report their group's predictions to the class.
- e. Allow students enough time to experiment with pressing in different points along the rubber band. *sc.*2.4.12 Direct the *recorder/reporter* from each group to record their observations. *GM*.1.2.5, *GM*1.3.2, *GM*2.2.12 Return to a full group discussion and ask the *recorder/reporter* to talk about what they observed.







Changing Pitch and Plucking Rubber Band (Note: Students can use one hand to press on the rubber band and the other to pluck the rubber band)

- 4. Direct students to gather around the teacher to closely watch a stretched rubber band as it is plucked. Ask them to describe what they see (it vibrates). Ask students if they notice anything about the vibrations and the sound (sound is only produced while the rubber band is vibrating). Explain that sound is created when something vibrates. sc.1.4.13 Tell students that all noises, including their voices and musical instruments, are caused by vibrations. Explain that many of the sounds produced by an orchestra, such as the sound of the drums can be felt, and that what they are feeling is actually the vibrations the instruments are producing as sound waves travel though the air.
- 5. Explain that the sound made by a string instrument is affected by the thickness of the string, by how tightly the string is stretched, and the length of the string. Explain that in the previous experiment students were changing the length of the part of the "string" allowed to vibrate. When the length of the string allowed to vibrate is shortened, the pitch goes up, and when it is lengthened, the pitch goes down. Explain that this is the same thing that string instrument musicians do when they press on the strings on the fingerboard of their instruments.
- 6. Optional: Using a string instrument, demonstrate how the pitch of a note changes when someone presses on the string while it is plucked. Allow students to look closely at the thickness of the strings and demonstrate how this influences the pitch of each note. Adjust the tension on each string by tightening and loosening each string by turning the tuning pegs of the instrument and demonstrate how this affects the pitch of each note. Be aware that this will require the instrument to be re-tuned, so <u>only</u> do this if you know how to re-tune the instrument or if the person who loaned the instrument to you is understanding.
- 7. Conclude the lesson by playing Peter's Theme as found in either the WVSO CD ROM or the WVSO Audio CD Companion to your class. Ask your students to close their eyes and imagine what the musicians must be doing to change the pitch of the notes that they are playing.

Assessment/Evaluation*:

1. Predictions and observations written by students in small groups.

Supplemental Materials and Equipment Needed:

Rubber bands Paper Pencils String instrument(s) (optional) A copy of the *Peter and the Wolf* CD ROM or WVSO Audio CD Companion Computer able to play audio files on CD ROM

Resources:

Information about sound: <u>http://www.physicsclassroom.com/Class/sound/soundtoc.html</u> Information about sound and how musical instruments produce sound: <u>http://www.pbs.org/weta/roughscience/challenges/music/</u> Information about the parts of an acoustic guitar: <u>http://entertainment.howstuffworks.com/guitar.htm</u>

References:

Ostdiek, Vern J. & Bord, Donald J. (2000). <u>Inquiry into Physics</u>. Brooks/Cole: Pacific Grove, CA.

National Standards:

Music

Performing on instruments, alone and with others, a varied repertoire of music.

Improvising melodies, variations and accompaniments.

Listening to, analyzing and describing music.

Evaluating music and music performances.

Understanding relationships between music, the other arts and disciplines outside the arts.

Science

Content Standard B

Position and motion of objects:

• Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

Social Studies

- V. Individuals, Groups, and Institutions
 - a. identify roles as learned behavior patterns in group situations such as student, family member, peer play group member, or club member.

WV Content Standard Objectives:

First-Grade

SC.1.4.13	demonstrate that sounds are produced by vibrations.
SC.1.6.1	listen to and be tolerant of different viewpoints while working in collaborative groups.
SS.1.2.1	identify and practice various group roles (e.g., group leader, recorder, reporter, collector) in the classroom.
GM.1.2.5	evaluate their own musical performances.
GM.1.3.2	create an original composition of at least one musical phrase.
Second-Grade	

SC.2.4.12	recognize that sound can change in pitch and volume.
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GM.2.2.12 evaluate their own musical performances.

Kentucky Program of Studies

AH-P-M-5
Students will identify and discuss the elements of music.
S-P-SI-2
Students will use simple equipment (e.g., aquariums), tools (e.g., magnifiers, spoons), skills (e.g., observing, pouring), technology (e.g., video discs), and mathematics in scientific investigations.
S-P-SI-3
Students will use evidence (e.g., observations) from simple scientific investigations and scientific knowledge to develop reasonable explanations.
S-P-SI-4
Students will design and conduct different kinds of simple scientific investigations.
S-P-SI-5
Students will communicate (e.g., speak, draw) designs, procedures, and results of scientific investigations.

Ohio Academic Content Standards:

First-Grade Y2003.CSC.S05.GKG-02.BA.L01.I01 Doing Scientific Inquiry / 01. Ask "what happens when" questions. Y2003.CSC.S05.GKG-02.BA.L01.I02 Doing Scientific Inquiry / 02. Explore and pursue student-generated "what happens when" questions. Y2003.CSC.S05.GKG-02.BC.L01.I04 Doing Scientific Inquiry / 04. Work in a small group to complete an investigation and then share findings with others. Y2003.CSC.S05.GKG-02.BC.L01.I09 Doing Scientific Inquiry / 09. Describe things as accurately as possible and compare with the observations of others. Y2003.CSS.S07.GKG-02.BC.L01.I05 Communicating Information / 05. Communicate information orally or visually. Y2003.CSS.S07.GKG-02.BD.L01.I06 Problem Solving / 06. Display courtesy and respect for others in group settings including: a. Staying on the topic; b. Focusing attention on the speaker.

Ohio Academic Content Standards: (Continued)		
Second-Grade		
Y2003.CSC.S03.GKG-02.BB.L02.I01		
Forces and Motion /		
01. Explore how things make sound (e.g., rubber bands, tuning fork and strings).		
Y2003.CSC.S03.GKG-02.BC.L02.I02		
Forces and Motion /		
02. Explore and describe sounds (e.g., high, low, soft and loud) produced by vibrating objects.		
Y2003.CSC.S05.GKG-02.BA.L02.I01		
Doing Scientific Inquiry /		
01. Ask "how can I/we" questions.		
Y2003.CSC.S05.GKG-02.BA.L02.I02		
Doing Scientific Inquiry /		
02. Ask "how do you know" questions (not "why" questions) in appropriate situations and attempt to give		
reasonable answers when others ask questions.		
Y2003.CSC.S05.GKG-02.BA.L02.I03		
Doing Scientific Inquiry /		
03. Explore and pursue student-generated "how" questions.		
Y2003.CSC.S05.GKG-02.BC.L02.I05		
Doing Scientific Inquiry /		
05. Use evidence to develop explanations of scientific investigations. (What do you think? How do you		
know?)		
Y2003.CSC.S05.GKG-02.BC.L02.I06		
Doing Scientific Inquiry /		
06. Recognize that explanations are generated in response to observations, events and phenomena.		
Y2003.CSC.S05.GKG-02.BC.L02.I10		
Doing Scientific Inquiry /		
10. Share explanations with others to provide opportunities to ask questions, examine evidence and suggest		
alternative explanations.		

*All Assessments are to be at the expected state assessment standard; in West Virginia this is mastery level; in Ohio this is benchmark level; and, in Kentucky, this is academic expectations level.