

PSI:

PHYSICAL SCIENCE INVESTIGATION



Teacher's Lesson Description

Title	Tuned In
Brief Description of the Videos	Dante conducts several experiments using two differently-sized tuning forks. In the video, students get an opportunity to observe and predict the behavior of sound waves in solids, liquids and gases.
Time Needed	40-60 minutes
Ohio Science Benchmarks and Indicators Addressed in This Activity	Grades 6-8 Physical Science Benchmark B Grades 6-8 Physical Science Benchmark D
Ohio Grade Level Indicators Addressed in This Activity	Grade 8 Physical Science Indicator 4 Grade 8 Physical Sciences Indicator 5
Concepts Developed	Students will learn to distinguish between wavelength and frequency and to establish the inverse relationship between the two. They will observe through a number of experiments and demonstrations that energy from sound waves can be transferred from one medium to another. They will determine the relationship between frequency and pitch.
Lesson Rationale	Students will see and feel the differences between higher and lower frequency sound waves and their effects. They will be able to identify wavelength and frequency, and the connections between

	the two phenomena, in transverse and longitudinal waves.
Background Knowledge for Teachers	Teachers should understand the concepts of wavelength, frequency, pitch, and amplitude. They should know the mathematical relationships among velocity, frequency, and wavelength and be familiar with the Doppler Effect.
Classroom Procedures	<p>To introduce the concepts of wavelength, amplitude and frequency, students will work in teams with long springs, setting up a variety of waves of different characteristics. As more people join in the work on one spring, wavelength will decrease and frequency will increase.</p> <p>Then, students will activate a variety of tuning forks, with frequencies as high as 4000 vibrations per second and as low as 125 vibrations per second. They will dip the end of the vibrating tuning fork into beakers of water and observe the effects. They will relate differences in the movement of the water in different trials to the frequency and wavelength of the tuning fork being used. (For the very high frequency tuning forks, students will listen carefully to and try to account for the change in pitch as the activated tuning fork meets the surface of the water.) In a similar activity, students will touch the end of an activated tuning fork to a suspended table tennis ball and observe the effects. For both the water and table tennis ball experiments, a strobe light can be helpful in showing the vibrations.</p> <p>In a group activity, students will experience the Doppler Effect both with a thrown ball with a beeper attached and with an activated tuning fork rotating quickly on the end of a string.</p>
Materials Needed	Tuning forks, beakers of water, table tennis ball(s), beeper or buzzer for Doppler Effect demonstration, strobe light (if available).
Science Connections	Students will experience, in both visual and tactile ways, the abstract concepts associated with the behavior of sound waves. Opportunities for extensions into the real world abound, as they can investigate the characteristics of supersonic flight, police radar, and weather forecasting. Hearing is one of humans' five senses. The sounds that humans can hear are connected to such things as vibrations of ear drums, the bones in the ear and skull, frequencies, wavelength, amplitude, and volume. For a very cool demo about how we hear, check out How Stuff Works:

	http://www.howstuffworks.com/hearing.htm
Additional Web Resources	<p>Music investigations from the San Francisco science museum, The Exploratorium, http://www.exploratorium.edu/music/</p> <p>Learn about the “Sound Barrier” http://hyperphysics.phy-astr.gsu.edu/Hbase/Sound/soubar.html</p> <p>Investigate the connections between mathematics, science and sound: http://www.philtulga.com/MSSActivities.html</p> <p>Sound Experiments for the Classroom: http://www.west.net/~science/sound.htm</p> <p>Movie Clip: Show and discuss the first 30 minutes or so of “The Right Stuff”, in which Chuck Yeager first breaks the sound barrier in his Bell X-1 aircraft. As an alternate, view this short YouTube documentary: http://www.youtube.com/watch?v=dke2i-xO1uo</p> <p>Here is an interesting video about Sonic Booms and the power of sound energy http://www.youtube.com/watch?v=-d9A2oq1N38</p> <p>“NOVA: The Wave That Shook the World,” describing the December, 2004 tsunami. http://www.pbs.org/wgbh/nova/tsunami/</p> <p>Series of videos on the physics of sound from the PBS program, “The Music Instinct.” http://www.pbs.org/wnet/musicinstinct/category/video/physics-of-sound</p> <p>Learn about Human Hearing – One of Our Five Senses: http://hypertextbook.com/facts/2003/ChrisDAmbrose.shtml</p>

Ohio Science Standards Abbreviations:

ES – Earth/Space Science
SI – Scientific Inquiry

LS – Life Sciences
ST – Science and Technology

PS – Physical Sciences
SW – Scientific Ways of Knowing

