

# Honors Physics - Unit 11 - Sound

## Unit Focus

Students will continue building on their prior knowledge from the previous unit, waves, and apply it to understanding musical instruments and everyday technologies like Doppler effect. Students will start by exploring the mechanics of sound in wind and stringed instruments and relate instrument design to pitch. They will continue by exploring harmonic frequencies and their relationship to the instruments' quality and timbre. Ultimately students will explore advanced topics as Doppler effect, beat frequency and sound transmission in various media.

## Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p><b>Next Generation Science</b> <i>High School Physical Sciences: 9 - 12</i></p> <ul style="list-style-type: none"> <li>Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. <i>HS-PS4-5</i></li> </ul> <p><b>Next Generation Science Standards (DCI)</b> <i>Science: 11</i></p> <ul style="list-style-type: none"> <li>At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. <i>PS3.9.A3</i></li> <li>The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. <i>PS4.9.A1</i></li> </ul> <p><b>Student Growth and Development 21st Century Capacities Matrix</b> <i>Critical Thinking</i></p> <ul style="list-style-type: none"> <li>Analyzing: Students will be able to examine information/data/evidence to make inferences and identify possible underlying assumptions, patterns,</li> </ul>	<p><b>T1</b> Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.</p>	
	<p><b>Meaning</b></p>	
	<p><b>Understanding(s)</b></p>	<p><b>Essential Question(s)</b></p>
	<p><b>U1</b> Wavelength, frequency, and amplitude are properties of a wave that determine its characteristics such as pitch, color, sound and energy. <b>U2</b> When waves encounter objects they can reflect or absorb depending on the property of material.</p>	<p><b>Q1</b> How are waves beneficial? <b>Q2</b> What are the implications of an object's natural frequency</p>
	<p><b>Acquisition of Knowledge and Skill</b></p>	
	<p><b>Knowledge</b></p>	<p><b>Skill(s)</b></p>
<p><b>K1</b> Sound transfers energy from the source to the receiver. <b>K2</b> Sound travels through various mediums that affect the speed of sound. <b>K3</b> There is a relationship of pitch to frequency and volume to amplitude. <b>K4</b> The Doppler effect explains the shift in frequency of a wave based on relative velocity between the source and observer <b>K5</b> Sound waves may combine to create additional (beat) waves <b>K6</b> The velocity of sound through air is temperature</p>	<p><b>S1</b> Students will be able to calculate and determine the harmonics of open-closed pipes, open-open pipes and strings. <b>S2</b> Students will be able perform calculations of various sound phenomena including the Doppler Effect and beats in everyday situations <b>S3</b> Students will be able to calculate the velocity of sound through various media given the properties of the medium <b>S4</b> Students will be able to calculate wavelength and amplitude of sound waves given graphs of the wave</p>	

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<p>and relationships. <i>MM.1.2</i></p> <p><i>Collaboration/Communication</i></p> <ul style="list-style-type: none"> <li>• <b>Collective Intelligence:</b> Students will be able to work respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. <i>MM.3.1</i></li> </ul>	<p>dependent</p> <p><b>K7</b> Standing waves (resonant frequencies) are required to produce sound waves; objects have natural resonant frequencies which governs how their pitch of their sound is defined</p> <p><b>K8</b> Timbre is the sound quality of an instrument, and depends on the combination of harmonics that instrument produces</p> <p><b>K9</b> Sound is a longitudinal wave; molecules vibrate and collide with each other to transmit sound information from the source to the receiver</p>	
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