

Physics > Big idea PSL: Sound, light and waves > Topic PSL5: Measuring waves

Key concept (age 14-16)

PSL5.1: Visualising waves

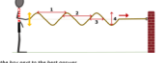
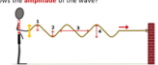
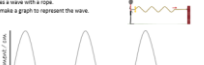










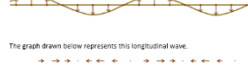
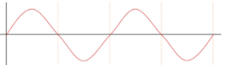
Progression toolkit: Visualising waves

Learning focus	The motion of particles in a wave can be represented by a displacement-distance or a displacement-time graph, from which the wave's amplitude and wavelength or time period can be found.				
As students' conceptual understanding progresses they can:	<div>CONCEPTUAL PROGRESSION</div>				
	Identify wavelength and amplitude on pictures of transverse waves.	Explain how a displacement-distance graph relates to the transverse wave it describes.	Explain how a displacement-time graph relates to the wave it describes.	Identify wavelength and amplitude on pictures of longitudinal waves.	Explain how a displacement-distance graph relates to the longitudinal wave it describes.
Diagnostic questions	The right wavelength	Rope wave graph	New wave graph	Longitudinal measurements	Spring wave graph
			Sound graph		
Response activities			Oscilloscope graph	Explaining longitude waves	

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

The right wavelength	Rope wave graph	New wave graph	Sound graph	Longitudinal measurements																																																												
<p>BEST STUDENT WORKSHEET</p> <p>The right wavelength</p> <p>Albert makes a wave with a rope. He can change the wavelength and the amplitude of the wave.</p> <p>1. What shows the wavelength of the wave?</p>  <p>Put a tick (✓) in the box next to the best answer:</p> <p>A. Arrow 1 <input type="checkbox"/> C. Arrow 3 <input type="checkbox"/> B. Arrows 1 and 2 <input type="checkbox"/> D. Arrow 4 <input type="checkbox"/></p> <p>2. What shows the amplitude of the wave?</p>  <p>Put a tick (✓) in the box next to the best answer:</p> <p>A. Arrow 1 <input type="checkbox"/> C. Arrow 3 <input type="checkbox"/> B. Arrows 1 and 2 <input type="checkbox"/> D. Arrow 4 <input type="checkbox"/></p> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>BEST STUDENT WORKSHEET</p> <p>Rope wave graph</p> <p>Albert makes a wave with a rope. He wants to make a graph to represent the wave.</p>  <p>How is the graph related to the wave on the rope?</p> <p>For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th></th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A. The graph shows the position of the rope in the case of one instant.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B. The graph is the exact shape of the rope.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C. Displacement is the distance of the rope above the ground.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A. The graph shows the position of the rope in the case of one instant.					B. The graph is the exact shape of the rope.					C. Displacement is the distance of the rope above the ground.					<p>BEST STUDENT WORKSHEET</p> <p>New wave graph</p> <p>Albert makes a wave with a rope. He wants to make a graph to represent the wave. The graph has time on the horizontal axis.</p>  <p>What does the displacement-time graph show?</p> <p>For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th></th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A. A snapshot of the wave on the rope.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B. The movement of one point on the rope.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C. Three complete wavelengths.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A. A snapshot of the wave on the rope.					B. The movement of one point on the rope.					C. Three complete wavelengths.					<p>BEST STUDENT WORKSHEET</p> <p>Sound graph</p> <p>A sound wave makes part of a microphone vibrate. The vibration can be shown on an oscilloscope. As part of the microphone vibrates in and out, the displacement on the graph goes up and down.</p>  <p>What does the line XY represent on the displacement-time graph? Put a tick (✓) in the box next to the best answer:</p> <p>A. The wavelength of the sound. <input type="checkbox"/> B. The time for part of the microphone to vibrate once. <input type="checkbox"/> C. The time for an particle to move from X to Y. <input type="checkbox"/></p> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>BEST STUDENT WORKSHEET</p> <p>Longitudinal measurements</p> <p>Particles in air move very, very quickly in all directions. They are bumping off each other all the time. A loud speaker adds an extra movement. The extra movement forms a sound wave.</p>  <p>What is the amplitude and wavelength of this wave?</p> <p>For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th></th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A. Amplitude is equal to the distance X.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B. Wavelength is equal to the distance the loudspeaker moves in and out.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C. Wavelength is equal to the distance X.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><i>The symbol for wavelength is the Greek letter lambda: λ.</i></p> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. 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<p>BEST STUDENT WORKSHEET</p> <p>Spring wave graph</p> <p>Making one end of a string forwards and backwards can make a wave.</p>  <p>Which graph represents the longitudinal wave on the part of string shown below?</p> <p>A.  B.  C.  D. </p> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>BEST STUDENT WORKSHEET</p> <p>Oscilloscope graph</p> <p>An oscilloscope and a microphone can be used to make a graph of a sound wave. The oscilloscope makes a displacement-time graph.</p>  <p>Use the statements to explain how a graph of a sound wave is made on an oscilloscope.</p> <p>Start with:</p> <p>Inside a microphone is a thin diaphragm that can move.</p> <p>A negative p.d. is made when it moves the other way. A positive p.d. is made when it moves one way.</p> <p>When it is on the dot moves across the screen at a steady speed. When it is off a sound wave can only move the dot up or down.</p> <p>A soundwave can move it backwards and forwards. Changing the time-base changes the scale on the time axis.</p> <p>This makes the dot on the oscilloscope move up or down. The time-base changes how quickly the dot moves across the screen.</p> <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>BEST STUDENT WORKSHEET</p> <p>Explaining longitudinal waves</p> <p>The particles in a longitudinal wave move forwards and backwards.</p> <p>Average position of undisturbed particles:</p>  <p>The movement of particles in a longitudinal wave can be compared to movement as a rope wave.</p>  <p>The graph drawn below represents this longitudinal wave.</p>  <p>To do:</p> <ol style="list-style-type: none"> Make a copy of the graph and add labels to each axis. Explain how the graph shows the movement of particles in a longitudinal wave. <p><small>Developed by the University of York Science Education Group, the Salter's Institute and the Institute of Physics. The document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>																																																														
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