



**Physics Scheme of Learning**

**P12: Waves**

**Intent – Rationale**

Waves are key part of Physics, and feature all the way through secondary school education and beyond. Waves are also a part of everyday life, and a key way in which energy and information, but not matter, are transferred. This topic builds on and goes beyond previous understanding of waves. It is an opportunity to development mathematical skills, including rearranging equations and using standard form.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
<p><b>Topic 8 Phys Waves and Sound</b> <b>Topic 9 Phys Light</b></p>	<ul style="list-style-type: none"> <li>• GCSE Physics P13 – Electromagnetic Spectrum, P14 – Light</li> <li>• A level – Year 12 topic Waves</li> </ul>
What are the links with other subjects in the curriculum?	What are the links to SMSC, British Values and Careers?
<ul style="list-style-type: none"> <li>• Base the content here on what you already know but there will be time in future to liaise further as part of our collaborative work</li> </ul>	<p>P12.1 The Nature of Waves GB4h P12.2 R.Prac 8 Waves Practical GB4a, GB4e, GB4f P12.4&amp;5 Sound waves GB4e P12.6 Ultra sound SP4 P12.7 Seismic waves C1 SP2</p>
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	What are the opportunities for developing mathematical skills?
<p>FROM THE LIBRARY <i>Matter and Waves-532</i></p>	<ul style="list-style-type: none"> <li>• Development of mathematical skills through use of the three wave equations.</li> <li>• Prefixes and standard form are used commonly in these calculations</li> </ul>



Physics Scheme of Learning

P12: Waves

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

State examples of both transverse and longitudinal waves.  
State the range of human hearing.  
State similarities and differences between sound waves and ultrasound waves.  
State uses of ultrasound waves.  
State advantages and disadvantages of using ultrasound waves for diagnosis.  
State that P-waves and S-waves are types of seismic wave.

Apply

Describe the properties of P-waves and S-waves.  
Perform calculations on ultrasound scans using the equation: distance = speed x time  
Describe and explain how echo sounding is used in a given situation, e.g., to find the depth of the ocean or to find fish when sea fishing.  
Describe and explain how P-waves and S-waves travel through the Earth's interior, and how this allows us to build up a picture of the Earth's interior.  
Describe how sound waves travel from a source to the ear and the effect that this has inside the ear.  
Describe sound waves in terms of pitch and frequency.  
Describe and explain how ultrasound waves are used to build up a picture of the inside of a human body.  
Describe the propagation of both transverse and longitudinal waves  
Apply the wave equation to measured values from a real world wave.  
Draw diagrams to show the features of transverse and longitudinal waves.  
Describe the propagation of both transverse and longitudinal waves  
Draw diagrams to show the features of transverse and longitudinal waves.

Extend

Explain how earthquakes are detected and the scale that they are measured on.  
Explain why sound waves travel faster in solids than they do in liquids and gases.



What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?
<p><b>amplitude</b> the height of a wave crest or trough of a transverse wave from the rest position. For oscillating motion, the amplitude is the maximum distance moved by an oscillating object from its equilibrium position</p> <p><b>compression</b> squeezing together</p> <p><b>echo</b> reflection of sound that can be heard</p> <p><b>electromagnetic waves</b> electric and magnetic disturbances that transfer energy from one place to another</p> <p><b>frequency</b> the number of wave crests passing a fixed point every second</p> <p><b>longitudinal waves</b> waves in which the vibrations are parallel to the direction of energy transfer</p> <p><b>mechanical wave</b> vibration that travels through a substance</p> <p><b>oscillate</b> move to and from about a certain position along a line</p> <p><b>primary seismic wave (P-wave)</b> longitudinal waves that push or pull on the material that they move through as they travel through the Earth</p> <p><b>rarefaction</b> stretched apart</p> <p><b>reflection</b> the change of direction of a light ray or wave at a boundary when the ray or wave stays in the incident medium</p> <p><b>refraction</b> the change of direction of a light ray when it passes across a boundary between two transparent substances (including air)</p> <p><b>secondary seismic wave (S-wave)</b> transverse waves that shake the Earth side to side as they pass through</p> <p><b>seismic waves</b> sound wave at frequency greater than 20 000 Hz (the upper frequency limit of the human ear)</p> <p><b>speed</b> the speed of an object (metres per second) = distance moved by the object (metres) ÷ time taken to move the distance travelled (seconds)</p> <p><b>transmission/transmitted</b> a wave passing through a substance</p> <p><b>transverse wave</b> a wave where the vibration is perpendicular to the direction of energy transfer</p> <p><b>ultrasound wave</b> sound wave at frequency greater than 20 000 Hz (the upper frequency limit of the human ear)</p> <p><b>vibrate</b> oscillate (move to and fro) rapidly about a certain position</p> <p><b>wavelength</b> the distance from one wave crest to the next</p>	<ul style="list-style-type: none"> <li>• Completion of an end of topic test</li> </ul> <p>P12.1 The Nature of Waves Assessing students progress through Isaac Physics calculation boards:</p> <ul style="list-style-type: none"> <li>• P6: Wave Equation Practice: Word Problems: <a href="https://isaacphysics.org/gameboards#afba0a3b-b087-45b5-bcf3-661ec239df16">https://isaacphysics.org/gameboards#afba0a3b-b087-45b5-bcf3-661ec239df16</a></li> <li>• P6: Frequency and Time Period Calculations: <a href="https://isaacphysics.org/gameboards#73fbda12-1b91-4655-904c-f36ab7e1d973">https://isaacphysics.org/gameboards#73fbda12-1b91-4655-904c-f36ab7e1d973</a></li> </ul> <p>P12.2 R.Prac 8 Waves Practical - Development of practical skills from lesson 2</p> <p>P12.4&amp;5 Sound waves - Answering of past exam questions through the assessed homework</p>



## Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
P12.1 The Nature of Waves	Can I draw diagrams to show the features of transverse and longitudinal waves? Can I give examples of both transverse and longitudinal waves? Can I describe the propagation of both transverse and longitudinal waves?	Can I explain why light can travel in space but sound cannot	
P12.2 R.Prac 8 Waves Practical	Can I apply the wave equation to measured values from a real world wave?	Can I evaluate a practical	
P12.3 Reflection, Refraction, wave model	Can I draw diagrams to show the features of transverse and longitudinal waves? Can I describe the propagation of both transverse and longitudinal waves?	Can I explain the law of reflection and its application	
P12.4&5 Sound waves	Can I state the range of human hearing? Can I describe how sound waves travel from a source to the ear and the effect that this has inside the ear? Can I describe sound waves in terms of pitch and frequency?	Can I explain why sound waves travel faster in solids than they do in liquids and gases?	
P12.6 Ultra sound	Can I give similarities and differences between sound waves and ultrasound waves? Can I state uses of ultrasound waves? Can I give advantages and disadvantages of using ultrasound waves for diagnosis? Can I perform calculations on ultrasound scans using the equation: distance = speed x time?	Can I describe and explain how echo sounding is used in a given situation? Can I describe and explain how ultrasound waves are used to build up a picture of the inside of a human body?	
P12.7 Seismic waves	Can I state that P-waves and S-waves are types of seismic wave? Can I describe the properties of P-waves and S-waves?	Can I explain how earthquakes are detected and the scale that they are measured on? Can I describe and explain how P-waves and S-waves travel through the Earth's interior, and how this allows us to build up a picture of the Earth's interior?	