EDEXCEL TOPIC 4 - WAVES

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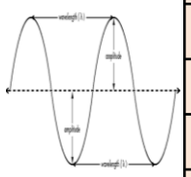


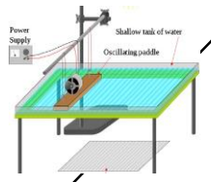
Velocity	*The speed of the wave in a certain direction*
Wavelength	*Distance from one point on a wave to the same point of the next wave*
Amplitude	*The maximum disturbance from its rest position*
Frequency	*Number of waves per second*
Wave front	*The position of all the particles of the medium, vibrating in the same state*
Period	*Time taken to produce 1 complete wave*

Wave speed	Wave speed = frequency X wavelength	V = f X λ
Wave period	Wave period = 1 ÷ frequency	T = 1 ÷ f
Wave Speed	Speed = distance ÷ time	v = d ÷ t

Sound waves travelling through different mediums, the frequency stay constant.

Equations

Core Practical



Determine the speed of frequency and wavelength of a wave in a solid and a fluid

Fluid - Using ripple tank

Solid – using peak frequency

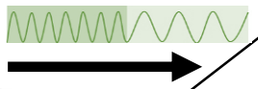
Basics of waves

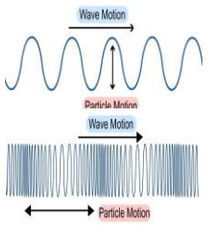
Waves transfer energy

Waves transfer energy and information in the direction they are travelling without transferring matter

When waves travel through a medium, the particles of the medium vibrate but stay in the same place. The energy and information is transferred between particles.

Medium	*Material through which waves travel.*





Transverse wave	*Vibration causing the wave is at right angles to the direction of energy transfer*	Energy is carried outwards by the wave.	Water and light waves, S waves.
Longitudinal wave	*Vibration causing the wave is parallel to the direction of energy transfer*	Energy is carried along the wave.	Sound waves, P waves.

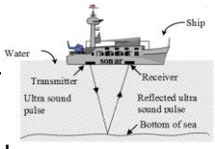
Measuring waves

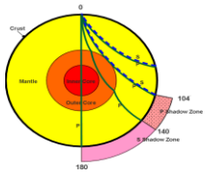
Speed

Measure the time it takes for waves to travel a certain distance

Time how long an echo takes to reach you (air)

Time how long a wave travels between 2 fixed points (water)





You must know how sound travels through the ear.

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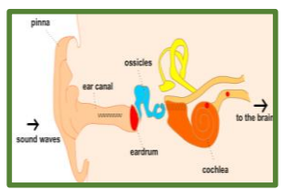
Sonar	*Reflected off objects*	Used to determine depth of objects under the sea.
Ultra sound	*Partially reflected off boundary*	Used for medical and foetal scans.
Infra-sound	*Seismic waves (P and S) used to explore Earth's core*	P waves can travel through the core, S waves cannot.

Ultrasound	*Above 20,000Hz*
Infrasound	*Below 20Hz*



Sound waves travel at different speeds in different media. Sound waves travel faster in solids, than liquids than gases.

Frequency does not change but wavelength does ($v = f\lambda$).

Wavelength increases as speed increases, if speed slows down, wavelength get shorter.

Properties of waves

Speed of Light = 3×10^8 m/s

Speed of sound = 340m/s

Wave speed = frequency X wavelength so if velocity changes either frequency or wavelength (or both) also changes

When waves travel from medium to medium, velocity, frequency and wavelength may be affected.

Sound waves have the same pitch regardless of medium travelled through.

Hearing

Frequencies between 20 – 20,000 Hz

Longitudinal waves cause ear drum to vibrate, amplified by three ossicles which creates pressure in the cochlea.

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Waves change speed due to the different density of mediums.

If the waves goes from a thinner medium to a thicker medium, (e.g. air to glass), it will slow down.

If the waves goes from a thicker medium to a thinner medium, (e.g. glass to air), it will quicken up.

What actually happens to a wave depends upon it's wavelength and the property of the material involved.

Refraction	*Waves changes direction at boundary.*

Waves travel through different medium at different speeds

Speed of waves in water depends upon depth

From deep water to shallow water, speed slows down

Sound waves enters a different medium, wavelength or velocity change.

PHSICS ONLY

Absorption	*Passes into but not out of, transfers energy and heats up the object.*
Transmission	*Passes through the object.*
Reflection	*Wave bounces off the surface.*
Refraction	*Waves changes direction at boundary.*

PHSICS HIGHER ONLY

Calculating depth or distance from time and wave velocity

Energy stored inside a system by particles	Internal energy is the total kinetic and potential energy of all the particles (atoms and molecules) in a system.
Heating changes the energy stored within a system	Heating causes a change in state. As particles separate, potential energy stored increases. Heating increases the temperature of a system. Particles move faster so kinetic energy of particles increases.

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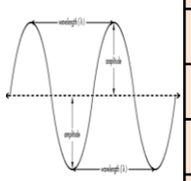

	The speed of the wave in a certain direction
	Distance from one point on a wave to the same point of the next wave
	The maximum disturbance from its rest position
	Number of waves per second
	The position of all the particles of the medium, vibrating in the same state
	Time taken to produce 1 complete wave

	Wave speed = frequency X wavelength	V = f X λ
	Wave period = 1 ÷ frequency	T = 1 ÷ f
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Sound waves travelling through different mediums, the frequency stay constant.

Equations

Basics of waves

	Material through which waves travel.

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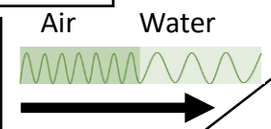

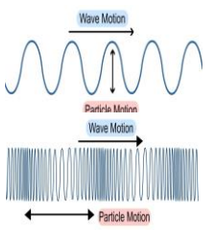

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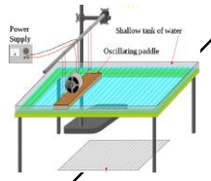
Measuring waves



Core Practical

Determine the speed of frequency and wavelength of a wave in a solid and a fluid

Fluid - Using ripple tank

Solid – using peak frequency

Speed	*Measure the time it takes for waves to travel a certain distance*	Time how long an echo takes to reach you (air)
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PHSICS HIGHER ONLY

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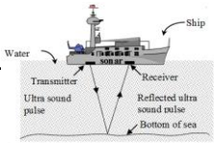
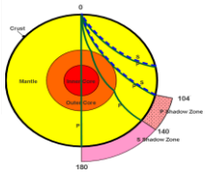
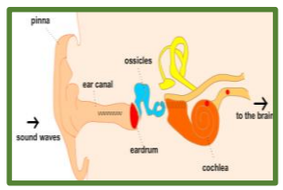




	Above 20,000Hz
	Below 20Hz



You must know how sound travels through the ear.

Frequencies between 20 – 20,000 Hz	Longitudinal waves cause ear drum to vibrate, amplified by three ossicles which creates pressure in the cochlea.

Sound waves travel at different speeds in different media. Sound waves travel faster in solids, than liquids than gases.

Frequency does not change but wavelength does (v = fλ).

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PHSICS ONLY

Passes into but not out of, transfers energy and heats up the object.	
Passes through the object.	
Wave bounces off the surface.	
Waves changes direction at boundary.	

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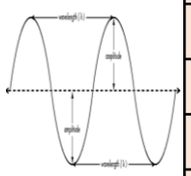
Velocity	
Wavelength	
Amplitude	
Frequency	
Wave front	
Period	



Wave speed		V = f X λ
Wave period		T = 1 ÷ f
Wave Speed		v = d ÷ t

Sound waves travelling through different mediums, the frequency stay constant.

Equations

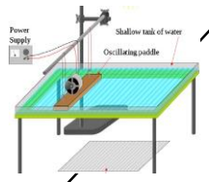
Core Practical

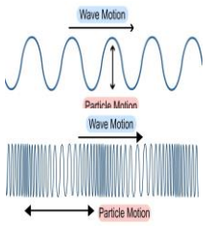
Waves transfer energy		

Medium	

Basics of waves

Air Water





Transverse wave			
Longitudinal wave			

Measuring waves

Speed		

Waves change speed due to

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If the waves goes from a thinner medium

If the waves goes from a thicker medium

Refraction	

Waves travel

Speed of waves in water depends

What actually happens to a wave depends upon

From deep water to shallow water,

Sound waves enters a different medium,

Properties of waves

Speed of Light =

Speed of sound =

When waves travel from medium to medium,

Wave speed = frequency X wavelength

Sound waves have the same pitch

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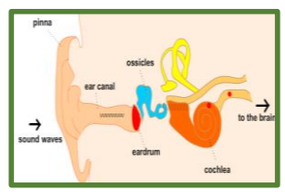
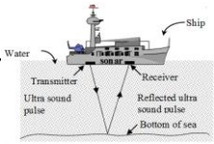
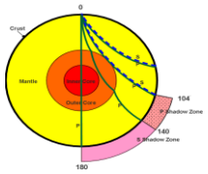
Sonar	
Ultra sound	
Infra-sound	

Ultrasound	
Infrasound	







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Sound waves travel at different speeds in different media. Sound waves travel faster in solids, than liquids than gases.

Frequency does not change

Wavelength increases as

Absorption	
Transmission	
Reflection	
Refraction	

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Calculating depth or distance from time and wave velocity		

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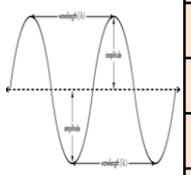
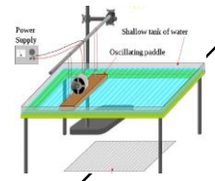


PiXL Science

Sound waves travelling through different mediums,

Equations

Core Practical



Medium | *Material through which waves travel.*

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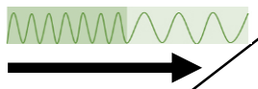

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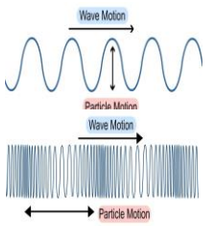
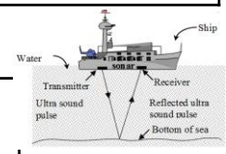
Measuring waves





HIGHER ONLY

Properties of waves

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Speed of sound =

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What actually happens to a wave depends

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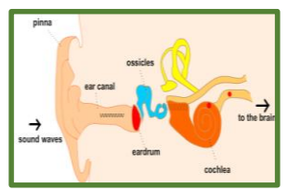

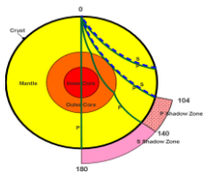

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