Foxford Learning Plan | KS4 Physics P06- Waves

Wave travel through materials and transfer energy.

Understanding - Over the course of the topic, I will understand:

- ☐ Describe the difference between a longitudinal and transverse wave
- ☐ Describe evidence that, for the ripple tank and sounds waves in the air, it is the wave and not the water or air itself that travels
- ☐ Describe wave motion in terms of amplitude, wavelength, frequency, and period
- ☐ Identify amplitude and wavelength from diagrams
- ☐ Describe a method to measure the speed of sound waves in air and on the surface of water
- ☐ Show how changes in velocity, frequency, and wavelength, in the transmission of sound waves from one medium to another, are inter-related
- ☐ Construct ray diagrams to illustrate reflection and refraction
- ☐ Describe the effects of reflection, transmission, and absorption of waves at material interfaces
- ☐ Higher only- describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids. For example, how sounds waves effect the ear drum
- ☐ Higher only- explain why such processes only work over limited frequency range and the relevance of this to human beings
- ☐ Higher only- explain how differences in velocity, absorption, and reflection between different waves in solids and liquids can be used both for detection and exploration of structures which are hidden
- ☐ Be aware of the study of seismic waves providing new evidence about parts of the Earth
- ☐ Give examples that illustrate the transfer in energy by electromagnetic waves
- ☐ Draw conclusions from data about the risks and consequences of radiation
- ☐ Higher only- explain why each type of electromagnetic wave is suitable for its use
- ☐ Draw the similarities and differences between convex and concave lenses
- ☐ Explain the differential absorption, transmission, and reflection of different wavelengths of light by an object
- ☐ Explain the effect of viewing objects through filters or the effect on light of passing through filters
- ☐ Explain why an opaque object has a particular colour
- ☐ Explain how temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted
- ☐ Use information to show how radiation effects the temperature of the Earth's surface and atmosphere

Skills - Over the course of the topic, I will:

- ☐ WS1.2- Use models and diagrams to illustrate ideas
- ☐ MS 3b +c- Apply an equation given on the equation sheet

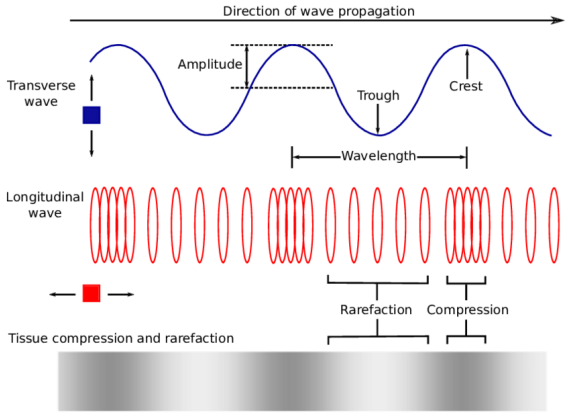
What is a wave?

There are two types of waves they are called Longitudinal and Transverse.

The height of a wave is called the amplitude and the distance between one wave and another is called the wavelength.

the number of complete waves passing a certain point each second is called the frequency (frequency = 1 ÷ period).

The amount of time it takes for one complete wave to pass a certain point is called the period (period = 1 ÷ frequency).

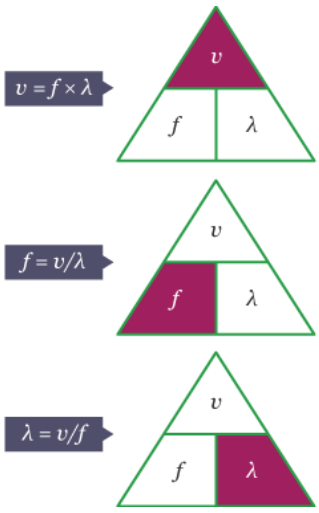


How is the wave equation used?

Speed in which a wave transfers energy is called wave speed. The unit for wave speed is m/s.

The V in the wave equation stands for velocity. The f in the equation stands for frequency. The unit for frequency is Hz. λ represents the wavelength The unit for wavelength is metres.

Wave speed = frequency x velocity



How is the speed of a wave be calculated?

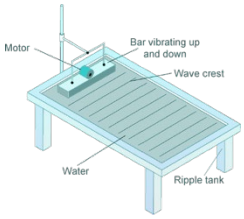
The speed of a wave can be calculated using this equation:

Speed = distance ÷ time.

Or Speed = Frequency x time

1. Set-up the ripple tank with 5cm of water.
2. Adjust the height of the wooden rod so that it touches the surface of the water.
3. Switch on the light and motor
4. Measure the length of 3 waves and divide it by 3 to calculate the wavelength.
5. Count the number of waves in 10 seconds.
6. Use the wavelength and frequency to calculate the wave speed.

The hazard in this practical is the electrical components near the water. The consequence being an electric shock.

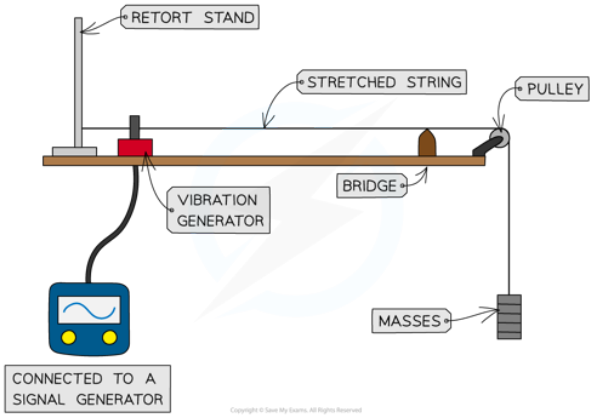


How is wave speed measured in a solid?

A string is vibrated by a vibration generator. Adjust the frequency until there is a clear wave on the string.

Measure the wavelength of as many waves and then divide by the number of waves to find the mean wavelength. Wave speed is calculated by frequency x wavelength.

The dependent variable for this practical is frequency and wavelength to calculate the wave speed.



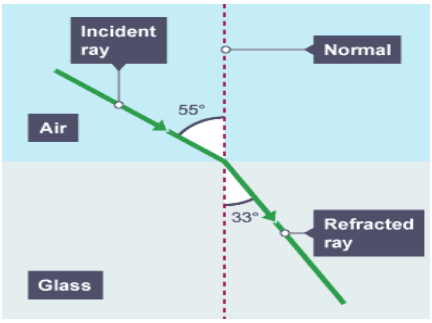
What is refraction?

When a wave changes direction as it crosses a boundary between two materials at an angle to the normal which is called refraction.

When a wave moves through a new medium (material) that is denser than the previous one, the wave speed slows down. This means that the wave will bend towards the normal.

When a wave moves through a new medium (material) that is less dense than the previous one, the wave speed, speeds up. This means that the wave will bend away from the normal.

The angle of incidence is the angle between the incident ray and the normal and the angle of refraction is the angle between the refracted ray and the normal.



What is the electromagnetic spectrum?

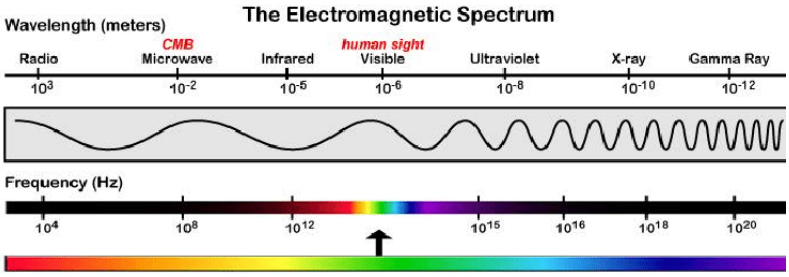
The electromagnetic spectrum is a continuous range of waves. The different types of electromagnetic radiation occur in different parts of the spectrum.

The order of the electromagnet spectrum is:

- Radio waves
- Microwave waves
- Infrared
- Visible light
- Ultraviolet
- X-ray
- Gamma waves

Radio waves have the lowest frequency and the longest wavelength, they also have the lowest energy. Whereas gamma rays have the highest frequency and the shortest wavelength, and they have the highest energy.

The speed of light is 3 x 10^8 m/s.



What is infrared radiation?

Infrared radiation is part of the electromagnetic spectrum.

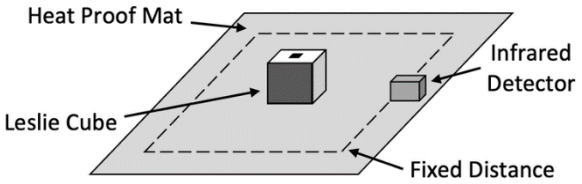
Infrared radiation is used in TV remotes, cooking and infrared cameras.

A leslies cube is a device that has different coloured surfaces and can be used to illustrate how the different surfaces emit radiation at different rates.

The independent variable in this practical was surface of the cube.

The dependent variable is temperature change for the different surfaces.

The control variable was the volume of water in the cube, the time between taking measurements.



Key vocabulary	
Amplitude	The height of the wave
Angle of incidence	The angle between the incident ray and the normal
Electromagnetic waves	Transverse waves that transfer energy from the source of the waves to an absorber. They form a continuous spectrum of different frequencies and all travel at the same speed in a vacuum
Frequency	The number of waves pass a given point in a second.
Hertz	Unit of frequency
Infrared radiation	A type of radiation that all objects absorb and emit. The hotter the object, the greater amount of infrared radiation.
Microwaves	Used for satellite communications and for cooking food.
Normal	Imaginary line reference line
Period	The time it takes for one complete wave to pass a given point. It is the inverse of frequency.
Radio wave	Used for television and radio signals.
Ultraviolet	Used in energy efficient lamps and for sun tanning
Visible light	The one type of electromagnetic radiation that our eyes can detect
Wave speed	The speed at which energy is transferred through a medium. It is equal to the product of the wave's wavelength and frequency
Wavelength	The distance from one point on one wave to the same point on the next wave