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- All waves carry energy from one place to another. There are two types of waves:
  - Transverse waves have vibrations perpendicular to the direction of travel (e.g. electromagnetic waves).
  - Longitudinal waves have vibrations in the same direction as that in which they are travelling (e.g. sound waves).
- The following words are used to describe waves:
  - Amplitude – the distance from the horizontal axis to the peak.
  - Wavelength ( $\lambda$ ) – the distance from peak to peak, or trough to trough.
  - Frequency – the number of complete waves per second (in Hz).
  - Period – the time taken for one complete wavelength (in s).
- All waves can be reflected, refracted and diffracted:
  - Reflection – a wave bouncing off a surface.
  - Refraction – a wave bending when it passes through a different medium.
  - Diffraction – a wave spreading out when it passes through a narrow gap.
- The wave formula:  
Velocity (m/s) = Frequency (Hz)  $\times$  Wavelength (m) –  $v = f \lambda$
- Sound is a longitudinal wave:
  - The amplitude is related to its volume (a higher amplitude means a higher volume).
  - The wavelength is related to its pitch (a shorter wavelength means a higher pitch).
- Sound is produced by objects vibrating:
  - The strings on a violin.
  - The surface of a drum.
  - The air in a trumpet.
  - The reeds in an oboe.
- Ultrasound is a high frequency sound wave, and is used in industry, medicine, quality control and sonar by transmitting the waves, and observing the way in which they are reflected back.
- The Earth consists of a crust, a mantle, a liquid outer core, and a solid inner core.
- There are two types of seismic waves:
  - P-waves are longitudinal. They travel through solids and liquids and are fast.
  - S-waves are transverse. They will only travel through solids and are slower than p-waves.
- Properties of reflection:
  - The angle of incidence is always equal to the angle of reflection.
  - An image is virtual, laterally inverted, and the same distance from the mirror as the object.
- Properties of refraction:
  - If a wave enters a denser medium (e.g. a perspex block), it will be bent towards the normal.

The emerging ray will come out at the same angle, but displaced.

  - A prism can be used to split white light into the visible spectrum.
  - When a wave passes into a different medium, it will either slow down or speed up.
- Properties of total internal reflection:
  - Total internal reflection is when a wave reflects off the inside of a block, rather than refracting out of it.
  - The critical angle for perspex is about  $43^\circ$ .
  - This principle is used in fibre optics (e.g. with endoscopes in medicine).

Physics Definitions

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1. Speed – Distance travelled per unit time.
2. Velocity – Rate of change of displacement.
3. Acceleration – Rate of change of velocity.
4. Electromagnetic induction is the phenomenon of producing an emf in a circuit due to changing magnetic field.
5. Amplitude refers to the maximum displacement from rest position.
6. Wavelength refers to the distance between one crest to the next successive crest.
7. Frequency refers to the number of waves produced per unit time.
8. Period refers to the time taken for one complete wave.
9. Speed refers to the distance travelled by the wave per unit time.
10. Echo is reflected sound from hard and smooth surfaces.
11. Sound is produced by vibrations placed in a medium
12. A Wave is a phenomenon in which energy is transferred through vibrations
13. Transverse waves are waves where the direction of travel is perpendicular to the direction of vibration of particle in a medium. (Light/water are transverse waves)
14. Longitudinal waves are waves where the direction of travel is parallel to the direction of vibration of particles in a medium. (Sound is longitudinal wave)
15. Kinetic energy – The ability to do work due to the object's speed.
16. Gravitational Potential energy – The ability to do work due to the object's height.
17. Inertia is an object's resistance to a change in velocity. (Heavier objects have greater inertia)
18. Work is done when an object moves in the same direction of the force acting on it.
19. Refraction is the bending of light ray as it travels across 2 different mediums.
20. Density – Mass per unit volume

All waves have the following properties:

Amplitude – the distance from the horizontal axis to the peak (in m)

Wavelength ( $\lambda$ ) – the distance from peak to peak, or trough to trough (in m).

Frequency – the number of complete waves per second (in Hz).

Period – the time taken for one complete wavelength (in s).

All waves can be reflected, refracted and diffracted:

Reflection – a wave bouncing off a surface.

Refraction – a wave changing direction when it passes from one material to another.

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Diffraction – a wave spreading out when it passes through a gap. Diffraction only occurs if the size of the gap is about the same as the wavelength of the waves.

The following formulae can be applied to waves:

Amplitude and Pitch – Sound Waves

The amplitude of a wave is related to volume or intensity - bigger amplitude means a higher volume or intensity.

The wavelength is related to its pitch or intensity (a shorter wavelength means a higher pitch or intensity).

Sound is produced by objects vibrating - the strings on a violin, the surface of a drum, the air in a trumpet, the reeds in an oboe. We may view the vibrations on a cathode ray oscilloscope in the normal way. Not all sounds are audible to the ear. Dog whistles produce sound at too high a pitch for the human ear, but the sound can be heard by dogs. Ultrasound/sonar are frequency sound waves, used in industry, medicine and quality control. Images may be formed using ultrasound and sonar by transmitting the waves, and observing the way in which they are reflected back.

P and S Waves

P and S waves are seismic waves. They are produced during earthquakes.

P-waves are longitudinal. They travel through solids and liquids and are fast. S-waves are transverse. They will only travel through solids and are slower than p-waves.

Properties of reflection:

The angle of incidence is always equal to the angle of reflection.

An image is virtual, laterally inverted, and the same distance from the mirror as the object.

Properties of refraction:

If a wave enters a denser medium (e.g. a perspex block), it will be bent towards the normal.

The emerging ray will come out at the same angle, but displaced.

A prism can be used to split white light into the visible spectrum.

When a wave passes into a different medium, it will either slow down or speed up.

Properties of total internal reflection:

Total internal reflection is when a wave reflects off the inside of a block, rather than refracting out of it.

The critical angle for perspex is about  $43^\circ$ .

This principle is used in fibre optics (e.g. with endoscopes in medicine).