Your notes

GCSE Physics: revision notes

Transverse and longitudinal waves

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Start here: what a wave is

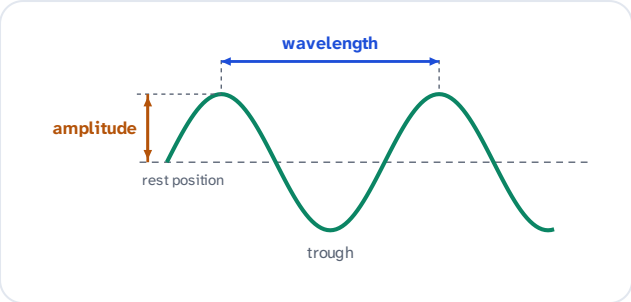
- A **wave** carries energy from one place to another without carrying matter. When a **wave** crosses a pond, the water moves up and down; it does not travel with the **wave**.
- In a **transverse wave**, the vibrations are at right angles to the direction the **wave** travels (light, water **waves**). In a longitudinal wave, they are along it (sound).
- Every **wave** has an **amplitude**, a **wavelength**, a frequency and a speed, and wave speed = frequency × wavelength.

What waves do

- **Waves** transfer energy from one place to another without transferring matter.
- For ripples on water and sound **waves** in air, it is the **wave** that travels, not the water or air itself. A floating object only bobs up and down as a ripple passes.

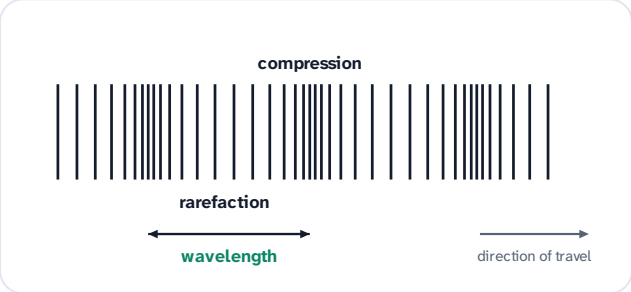
Transverse waves

- In a **transverse wave**, the oscillations (vibrations) are perpendicular (at right angles) to the direction of energy transfer.
- Examples: ripples on the surface of water, **waves** on a string, and all electromagnetic **waves**, such as light.
- **Transverse waves** have peaks (crests) and troughs.



Longitudinal waves

- In a **longitudinal wave**, the oscillations are parallel to the direction of energy transfer.
- They have areas of **compression** (particles close together) and **rarefaction** (particles spread out).
- Example: sound **waves** travelling through air. Seismic P-**waves** are also longitudinal.



Describing waves

- **Amplitude**: the maximum displacement of a point on a **wave** away from its undisturbed position.
- **Wavelength** (λ): the distance from a point on one **wave** to the equivalent point on the next **wave**, for example peak to peak.
- **Frequency** (f): the number of **waves** passing a point each second, measured in hertz (Hz).
- **Period** (T): the time for one complete **wave** to pass a point. $T = 1 \div f$.

Exam tip

- Use $v = f \lambda$, and convert units first, such as kHz to Hz.
- Show **amplitude** and **wavelength** clearly on a diagram: **amplitude** goes from the middle to a peak, and wavelength goes from one point to the same point on the next wave.

Common mistakes

- Measuring **amplitude** from peak to trough.
- Saying **waves** carry the material along. They transfer energy, not matter.

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Worked examples

A wave has a frequency of 50 Hz and a wavelength of 4 m. Find its speed.

Write the equation: wave speed = frequency × wavelength. **$v = f \lambda$**

Put the numbers in. **50×4**

Answer: 200 m/s

A sound has a frequency of 680 Hz and travels at 340 m/s. Find its wavelength.

Rearrange $v = f \lambda$ for the wavelength. **$\lambda = v \div f$**

Put the numbers in. **$340 \div 680$**

Answer: 0.5 m

Key terms

Wave	A way of transferring energy without transferring matter.
Transverse wave	A wave whose oscillations are perpendicular to the direction of energy transfer.
Longitudinal wave	A wave whose oscillations are parallel to the direction of energy transfer.
Compression	A region of a longitudinal wave where the particles are close together.
Rarefaction	A region of a longitudinal wave where the particles are spread out.
Amplitude	The maximum displacement of a point on a wave from its undisturbed position.
Wavelength	The distance from one point on a wave to the same point on the next wave.
Frequency	The number of waves passing a point each second, in hertz.
Period	The time taken for one complete wave to pass a point.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What do waves transfer?
2. In a transverse wave, how are the oscillations arranged?
3. Which of these is a longitudinal wave?
4. What is a compression?
5. What is amplitude?
6. What is wavelength?

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7. What is the unit of frequency?
8. A wave has a frequency of 50 Hz. What is its period?

Answers

1. Energy
2. Perpendicular to the direction of energy transfer
3. Sound in air
4. A region where particles are close together
5. The maximum displacement from the undisturbed position
6. The distance from a point on one wave to the same point on the next
7. Hertz (Hz)
8. 0.02 s

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

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