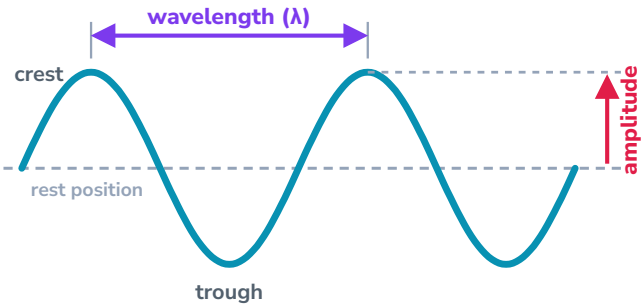
GCSE · PHYSICS · FOUNDATION & HIGHER

Wave properties

Learn with Fred
cheat sheet

Waves **transfer energy** from place to place **without transferring matter**. The particles just vibrate about a fixed position.

1 Parts of a wave



Property	Meaning	Unit
amplitude	maximum displacement from the rest position	m
wavelength λ	distance from a point to the same point on the next wave	m
frequency f	number of waves passing a point each second	Hz
period T	time for one complete wave	s

2 Two kinds of wave

Transverse vibrations **at right angles** to the direction of travel. Light, ripples on water.

Longitudinal vibrations **along** the direction of travel: squashed **compressions** and stretched **rarefactions**. Sound.

Sound needs a **medium**, so it cannot travel through a vacuum.

3 Wave speed

$$v = f \times \lambda$$

v wave speed (m/s) **f** frequency (Hz) **λ** wavelength (m)

Example

f = 200 Hz, λ = 1.5 m

v = 200 × 1.5 = 300 m/s

Rearranged: **f = v ÷ λ** and **λ = v ÷ f**. All EM waves travel at 3×10^8 m/s in a vacuum.

4 Period

$$T = \frac{1}{f}$$

Example

f = 50 Hz

T = 1 ÷ 50 = 0.02 s

Higher frequency means a **shorter** period. Going back: **f = 1 ÷ T**, so T = 0.25 s gives f = 1 ÷ 0.25 = 4 Hz.

Watch out

- ✕ Mixing up **amplitude** (rest line to crest) with the whole height from trough to crest, which is **twice** the amplitude.
- ✕ Thinking the **medium travels** with the wave. It only vibrates on the spot.
- ✕ Using **cm** or **km** in v = f × λ. Convert to **metres** first.
- ✕ Thinking a bigger amplitude means a higher frequency or speed. They are **independent**.

Exam tips

- Write the **equation first**, then substitute, then give the answer **with units**.
- Describe a longitudinal wave using **compressions** and **rarefactions**, and say which way the particles vibrate.
- To get f from T, or the other way round, use **1 ÷ the other one**.

Try it: a wave has frequency 5 Hz and wavelength 0.4 m. What is its speed and its period?

Check your answer with Fred: scan the code or go to **learnwithfred.co.uk/cs** to try Learn with Fred free.