

Waves in GCSE Physics

GCSE Physics

March 10, 2025

Transverse and Longitudinal Waves

Key Points:

- ▶ Ripples on a water surface are examples of transverse waves.
- ▶ Longitudinal waves show areas of compression and rarefaction (e.g., sound waves in air).
- ▶ It is the wave that travels, not the medium (water or air).

Properties of Waves

Key Definitions:

- ▶ **Amplitude:** Maximum displacement from the undisturbed position.
- ▶ **Wavelength:** Distance between the same point on two adjacent waves.
- ▶ **Frequency:** Number of waves passing a point per second.

Required Practical: Measuring Wave Properties

Observations:

- ▶ Identify suitable apparatus for measuring wave frequency, wavelength, and speed.
- ▶ Conduct experiments using a ripple tank and a vibrating string.

Reflection of Waves (Physics Only)

Wave Behavior at Boundaries:

- ▶ Waves can be reflected at the boundary between two materials.
- ▶ They can also be absorbed or transmitted.

Sound Waves (Physics HT Only)

Key Properties:

- ▶ Sound waves travel through solids by causing vibrations.
- ▶ In the ear, vibrations in the ear drum cause the sensation of sound.
- ▶ Human hearing is limited to 20 Hz to 20 kHz.

Waves for Detection and Exploration (Physics HT Only)

Uses of Waves:

- ▶ Ultrasound waves reflect at boundaries, allowing medical and industrial imaging.
- ▶ Seismic waves provide evidence about Earth's structure.
- ▶ Echo sounding uses high-frequency waves to detect underwater objects.

Electromagnetic Waves

Key Properties:

- ▶ Transverse waves transferring energy from source to absorber.
- ▶ Travel at the same velocity in a vacuum or air.
- ▶ Visible light is just one part of the electromagnetic spectrum.

Properties of Electromagnetic Waves 1 (HT Only)

Wave Interactions:

- ▶ Different substances absorb, transmit, refract, or reflect electromagnetic waves.
- ▶ Refraction occurs due to changes in wave velocity across different media.

Properties of Electromagnetic Waves 2 (HT Only)

Key Points:

- ▶ Radio waves induce oscillations in electrical circuits.
- ▶ Gamma rays originate from atomic nucleus changes.
- ▶ UV, X-rays, and gamma rays can be hazardous.

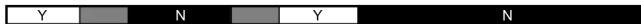
Uses of Electromagnetic Waves

Applications:

- ▶ Radio waves - communication.
- ▶ Microwaves - cooking and satellites.
- ▶ Infrared - heaters and night vision.
- ▶ Visible light - fibre optics.
- ▶ UV - sterilisation.
- ▶ X-rays and gamma rays - medical imaging.

Waves

Penetrates Earth's Atmosphere?



Radiation Type
Wavelength (m)

Radio
 10^3

Microwave
 10^{-2}

Infrared
 10^{-5}

Visible
 0.5×10^{-6}

Ultraviolet
 10^{-8}

X-ray
 10^{-10}

Gamma ray
 10^{-12}

Approximate Scale
of Wavelength



Buildings

Humans

Butterflies

Needle Point

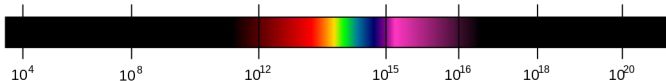
Protozoans

Molecules

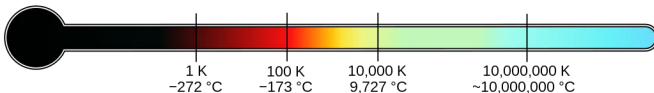
Atoms

Atomic Nuclei

Frequency (Hz)



Temperature of
objects at which
this radiation is the
most intense
wavelength emitted



Lenses (Physics Only)

Types of Lenses:

- ▶ Convex lenses converge light to a focal point.
- ▶ Concave lenses spread light outwards.
- ▶ The magnification equation: $\text{Magnification} = \frac{\text{image height}}{\text{object height}}$.

Visible Light (Physics Only)

Key Points:

- ▶ Colours correspond to different wavelengths.
- ▶ Smooth surfaces cause specular reflection.
- ▶ Rough surfaces cause diffuse reflection.

Black Body Radiation (Physics Only)

Key Principles:

- ▶ All objects emit infrared radiation.
- ▶ Hotter objects emit more radiation.
- ▶ A perfect black body absorbs all radiation and is also the best emitter.