# GCSE Physics Key Facts – Waves

## Waves in air, fluids and solids

Transverse waves (e.g. water and electromagnetic waves) have vibrations that are perpendicular to the direction of energy transfer of the wave.

Longitudinal waves (e.g. sound) have vibrations that are parallel to the direction of energy transfer of the wave. They have areas of compression and rarefaction.

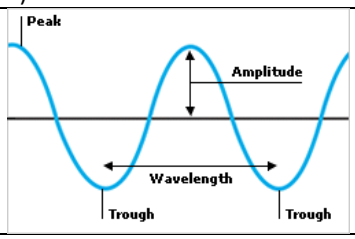
Energy is transferred by waves, not any material that the wave may be travelling through.

Time period equation:

T = 1/f (given on the equation sheet)

T = time period (s)
f = frequency (Hz)

The **amplitude** of a wave is the maximum displacement of a wave from its undisturbed position.
The **frequency** is the number of wave crests passing a point in one second.
The **wavelength** is the distance from one wave crest (or trough) to the next wave crest (or trough).




Wave equation:
$v = f \lambda$

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

Measuring speed of sound: Stand 100m away from a starting pistol. Time from seeing the starting pistol fire to hearing it.
Speed = distance/time

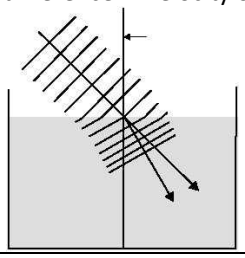
## Electromagnetic Waves

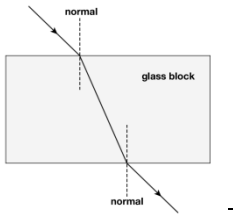
Electromagnetic waves are transverse waves that all travel at the same speed through a vacuum or air

The electromagnetic waves starting with the longest wavelength (lowest frequency) are: radio, microwave, infrared, visible light (red to violet), ultraviolet, X-rays and gamma rays.

HIGHER TIER ONLY Different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength.

Some effects, for example refraction, are due to the difference in velocity of the waves in different substances.






HIGHER TIER ONLY Radio waves can be produced by oscillations in electrical circuits. When radio waves are absorbed they may create an alternating current with the same frequency as the radio wave itself, so radio waves can themselves induce oscillations in an electrical circuit.

Gamma rays are caused by changes in the nucleus of an atom.
Ultraviolet waves, X-rays and gamma rays can have hazardous effects on human body tissue. The effects depend on the type of radiation and the size of the dose (measured in sieverts)

Ultraviolet waves can cause skin ageing and increase the risk of skin cancer. X-rays and gamma rays are ionising and can cause mutation of genes and cancer

Applications of electromagnetic waves:
radio waves – television and radio
microwaves – satellite communications, cooking food
infrared – electrical heaters, cooking food, infrared cameras
visible light – fibre optic communications
ultraviolet – energy efficient lamps, sun tanning
X-rays and gamma rays – medical imaging and treatments.
(HT only) give brief explanations why each type of electromagnetic wave is suitable for the application