

Y10 Waves – What you need to know

2.1 General properties of waves

- a) Waves transfer energy and information without transferring matter.
- b) In a transverse wave the oscillations are perpendicular to the direction of energy transfer.
- c) In a longitudinal wave the oscillations are parallel to the direction of energy transfer. Longitudinal waves show areas of compression and rarefaction.
- d) Electromagnetic waves are transverse, sound waves are longitudinal and mechanical waves may be either transverse or longitudinal.
- e) Waves can be reflected, refracted and diffracted.

You should be able to draw diagrams showing reflection, refraction and diffraction using rays and/or wavefronts.

You should appreciate that for appreciable diffraction to take place the wavelength of the wave must be of the same order of magnitude as the size of the obstacle or gap.

- f) When identical sets of waves overlap they interfere with each other.
- g) Waves may be described in terms of their frequency, wavelength, time period and amplitude.

You should be able to explain the meaning of these terms.

- h) The relationship between wave speed v , frequency f and wavelength λ is:

$$v = f \times \lambda$$

2.2 The electromagnetic spectrum

a) Electromagnetic waves form a continuous spectrum and all types of electromagnetic wave travel at the same speed through a vacuum (space).

You should know the order of electromagnetic waves within the spectrum, in terms of energy, frequency and wavelength.

You should appreciate that the wavelengths of the electromagnetic spectrum range from 10^{-15} m to 10^4 m and beyond.

b) Radio waves, microwaves, infrared and visible light can be used for communication.

c) Electromagnetic waves have many uses. For example:

radio waves – television and radio (including Bluetooth)

microwaves – mobile phones and satellite television

infrared – remote controls

visible light – photography

ultraviolet – security marking

X-rays – medical imaging

gamma rays – sterilising surgical instruments and killing harmful bacteria in food.

d) Exposure to electromagnetic waves can be hazardous. E.g.:

microwaves – heating of body tissue

infrared – skin burns

ultraviolet – skin cancer and blindness

X-rays – high doses kill cells

gamma rays – genetic mutations.

e) X-rays are part of the electromagnetic spectrum. They have a very short wavelength, high energy and cause ionisation.

f) Properties of X-rays include:

they affect a photographic film in the same way as light

they are absorbed by metal and bone

they are transmitted by soft tissue.

g) X-rays can be used to diagnose some medical conditions, for example in computed tomography (CT) scanning, bone fractures and dental problems. X-rays are also used to treat some conditions, for example in killing cancer cells.

h) The use of high energy ionising radiation can be dangerous, and precautions need to be taken to monitor and minimise the levels of radiation that people who work with it are exposed to.