IGCSE Coordinated Science: General Wave Properties

General Wave Properties

1 Demonstrate understanding that wave motion transfers energy without transferring matter in the direction of wave travel.

The statement is what it says above. However, I want to clarify some things in terms of how a wave motion can transfer energy without actually transferring any matter.

Consider the following example. You're friend is on a swing. Let's just assume that you're friend is incompetent and you have to push him. You push him, but you don't have to fly off with him, your mass can stay where it originally belonged (on the floor). You simply have to transfer the kinetic energy from your muscles (I assume you're pushing your friend with your hand), to his swing. Basically, you're pushing his mass with a bit of yours, which allows the swing to have enough energy to elevate the swing , but you don't have to physically fly off as well.

Long story short, wave motion transfers energy, however the matter does not have to be transferred.

2 Describe what is meant by wave motion as illustrated by vibration in ropes and springs and by experiments using water waves.

Wave motion is the transfer of energy from one point to another.

E.g.

- Vibration in ropes: Particles in rope vibrate in a fixed position and energy in the particles are transferred from one end of the rope to the other end. Wave travels as a "sideway pulse"
- Water ripples: An object that is floating experiences both "up and down" motions.

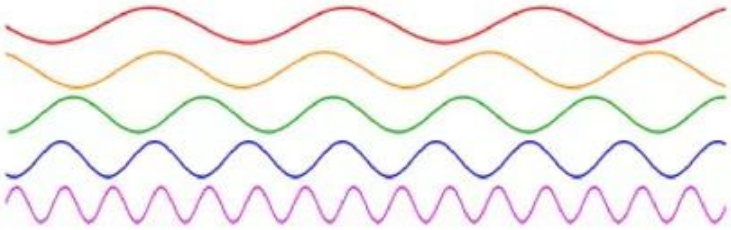
3 State the meaning of and use the terms speed, frequency, wavelength and amplitude.

Amplitude

The maximum displacement a point moves from its rest position when the wave passes. Since this is displacement, we usually give amplitude the same units as we would for distance/displacement. E.g. metre, kilometre

Frequency

The number of waves passing any given point each second, measured in Hertz (Hz).

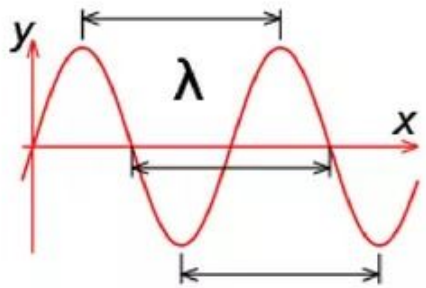


Waves of different frequencies.

Wavelength (λ)

The shortest distance in which two closest points on a wave are in phase. Measured in metres, kilometres etc.

Example below:



4 Distinguish between transverse and longitudinal waves and give suitable examples

There are ultimately two types of waves:

Transverse Waves:

Wave oscillation is perpendicular to direction of energy propogation

Examples include:

- Seismic S waves
- Light rays
- Electromagnetic waves

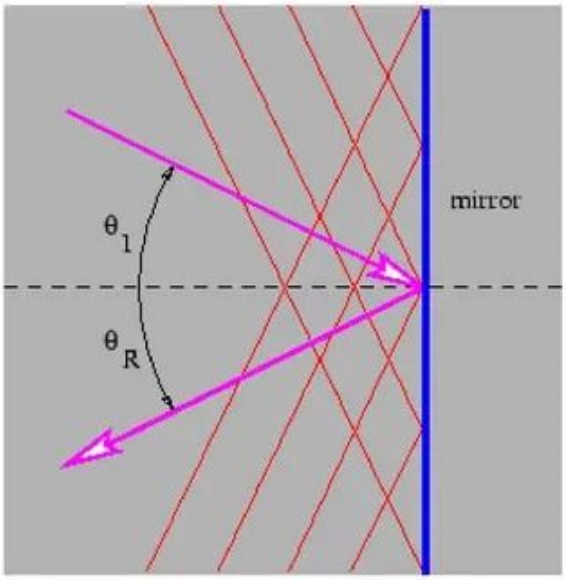
Longitudinal waves

Wave oscillation is parallel to direction of energy propogation

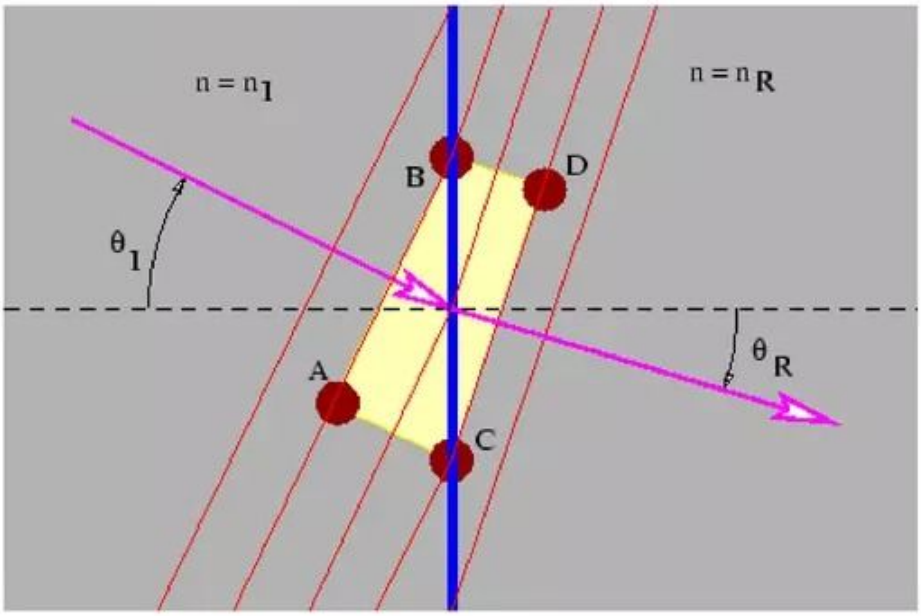
Examples include:

- Seismic P waves
- Sound waves.

5 Identify how a wave can be reflected off a plane barrier and can change direction as its speed changes.



Reflection: If a wave hits a mirror plane, and the plane is nice and smooth, the wave will be *directly bounced off and reflected.*



Refraction: If the surface of the mirror/medium has interference and is not completely smooth, the wave is partially reflected but most of the wave will be refracted instead. Refraction means that the wave passes through the interface, and in the process acquiring a different direction from the trajectory of the wave that first hit the interface/medium.

During refraction, because the wave travels through a medium, naturally, its speed will also decrease. Most electromagnetic

waves travel through the medium at the speed of light, but when they are refracted, they travel at a slower speed.