Waves

4. Wave Properties

CONCEPT 2

LESSON GUIDE

EXPLORING WAVES

PRECISE LEARNING POINTS

KNOW

I know how to identify the properties of waves.

APPLY

I can apply my knowledge to explain wave phenomena.

EXTEND

I can extend my knowledge to explain superposition.

NOTES

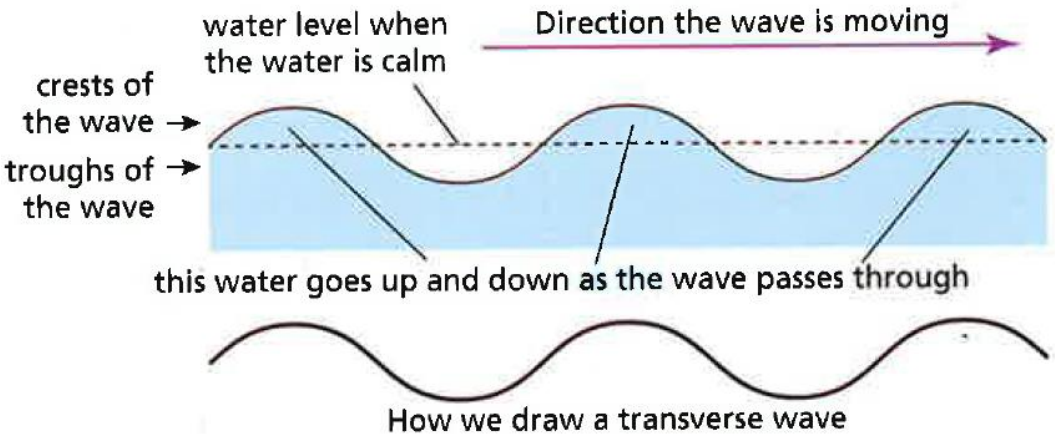
All waves must be able to do the following four things:

- reflect
- refract
- diffract
- interfere

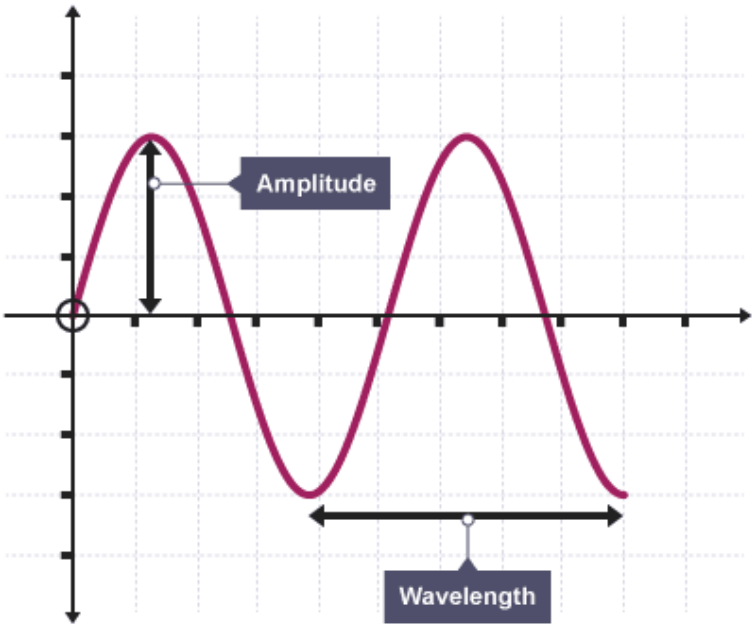
If it can't do one of these then it is not a wave!

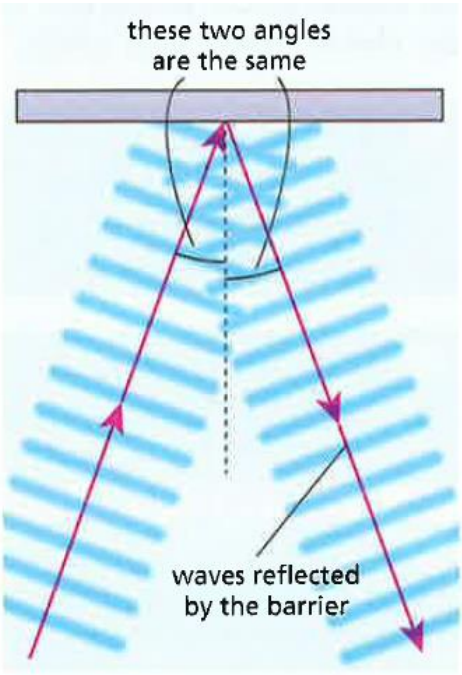
We will explore some properties of waves by looking at water waves. Water waves are **transverse** waves with the surface of the water moving up and down. The waves form crests and troughs, where the level is higher or lower than when the water is calm (rest position). The wave has a direction; we can see where it is coming from and going to. This means we can measure its speed.

We can also view the shape of the waves as they appear from the side. This makes it clear that they are transverse; we can see how long each wave is and how high (or low). This is called **amplitude** and is measured from the level of the water when it is calm to either the peak of a crest or the bottom of a trough.



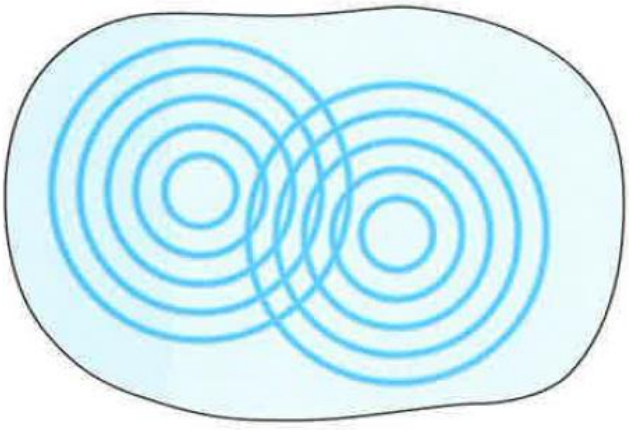
How we draw a transverse wave





Just as sound waves are reflected by hard surfaces, so water can undergo reflection. Their behaviour can be explored using a water tank. If some single straight water ripples are generated in the tank, then blocking their path shows how the wave is reflected by the barrier and the angle it is reflected at is the same as the angle it arrived at.

We won't discuss refraction and diffraction at this stage of science at school.

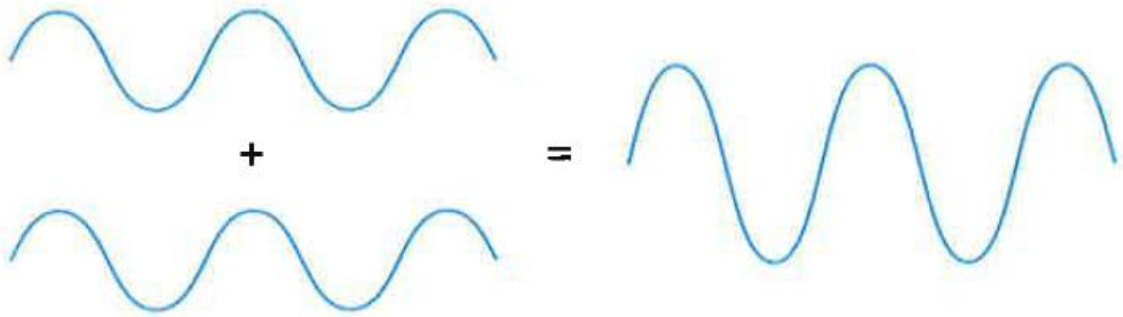


Interference can be seen when two pebbles are thrown into water. The ripples that they both produces spread out form the point of entry of each pebble. As the ripples move out they meet one another.

When two ripples meet they will interfere with each other.

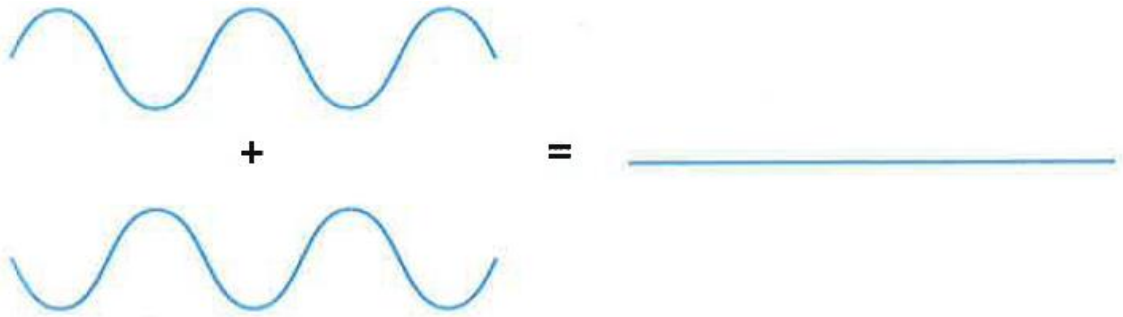
We will assume both wave have the same frequency, wavelength and amplitude. We will consider two situations:

1. When the crest of one wave meets the crest of the other wave.



The crest of each wave add together to make a new wave that is double the amplitude.

2. When the crest of one wave meets the trough of the other wave.



The crest of one cancels the trough of the other to make a new wave but with zero amplitude – so a flat line along the rest position.

There are many different possible interference interactions but these are the extremes of what can happen.

The combination of the amplitudes of waves as they interfere is called **superposition**.