Waves

4. Wave Properties

CONCEPT 1

LESSON GUIDE

TRANSVERSE AND LONGITUDINAL WAVES

PRECISE LEARNING POINTS

KNOW

I know that waves can be transverse or longitudinal.

APPLY

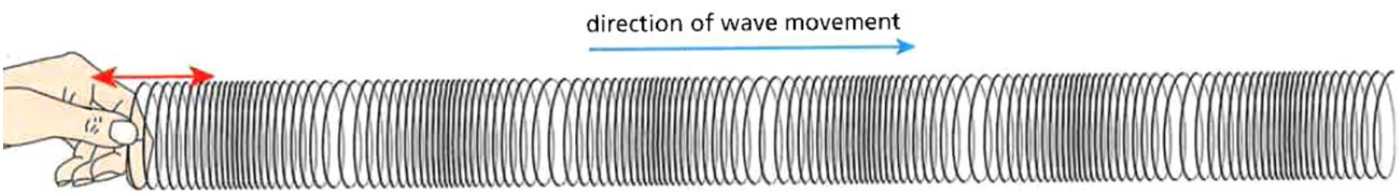
I can apply my knowledge to explain the differences between transverse and longitudinal waves.

EXTEND

I can extend my knowledge to draw and label properties of a transverse wave.

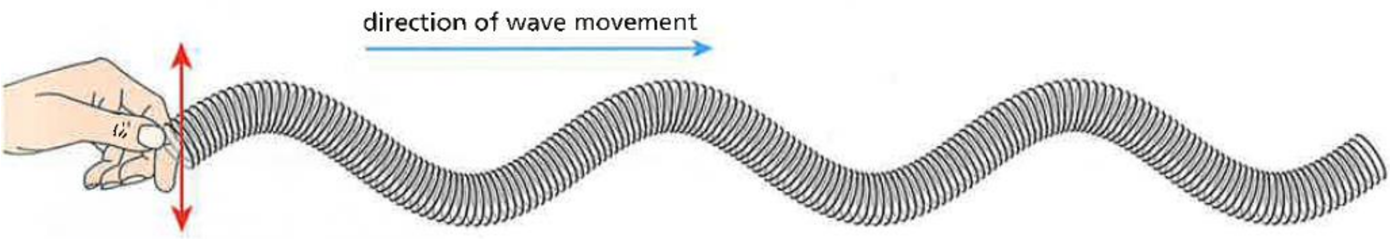
NOTES

If we push and pull the end of a slinky we make a **longitudinal** wave. This means that the energy we put into the slinky travels along the length of the slinky. Each coil of the slinky will move back and forth. This oscillation causes the next coil to move and so on. This repeating motion produces a pressure wave that moves along the slinky.



We say that for a **longitudinal** wave, the direction of oscillation is in the **same direction** as the direction of wave movement.

If we waggle the end of the slinky up and down then we make a **transverse** wave. This means that te energy we put into the slinky travels along the length of the slinky but by causing each coil in succession to also waggle up and down.



We say that for a **transverse** wave, the direction of oscillation is **at right angles** to the direction of wave movement.

For both types of waves, the frequency of oscillation will be the same as the initial oscillation of the hand. For a repeating oscillation, there will be points along each wave that look to be in the same position. We say that **the distance between these identical points is one wavelength**. In Physics, we label the wavelength with the Greek letter **lambda**, **λ**.

Longitudinal waves work using changing pressure. There are areas of high pressure (show above where the coils are closer together) and areas of low pressure (where the coils are further apart). The wavelength of a longitudinal wave would be the distance from one high pressure point to the next high pressure point. Equally, it could be from one low pressure point to the next low pressure point.

Transverse waves have areas where the amplitude is high called crests (or peaks) and areas where the amplitude is low called troughs. One full wave must have one crest and one trough. This can either be one whole crest and one whole trough, or a combination of fractions of these e.g. half a crest, one whole trough, and half a crest.

Both types of waves carry energy from one end (called the transmitter) to the other end (called the receiver).

Longitudinal wave examples:

- sound
- vibrations
- seismic p-waves (fastest waves emerging from the focus of an earthquake)

It is possible to hear a pin dropping onto a table from across a room because the pin hitting the table causes vibrations through the table. These vibrations can cause air particles to vibrate creating sound. We hear this sound as the air particles next to our ear drums are vibrated.

Sound waves lose energy the further they travel from the original vibration. With each oscillation along the longitudinal wave some energy is lost as heat to the surroundings. This means that sound waves will be heard quieter the further from the source you are. Louder original vibrations or sounds will travel further before losing energy. Explosions can be heard from very far away. Whispers can barely be heard across a room.

Transverse wave examples:

- radio waves
- microwaves
- infrared waves
- visible light
- ultraviolet
- x rays
- gamma rays
- seismic s-waves (slower waves emerging from the focus of an earthquake)
- Mexican wave (crowd at a sports event)
- water

Both of waves have the same types of properties: **wavelength**, **amplitude**, **frequency** and **wave speed**. We can find some of these features by drawing wave diagrams. It is much easier to draw and label transverse waves than it is to draw and label longitudinal waves.

This diagram shows two transverse waves.