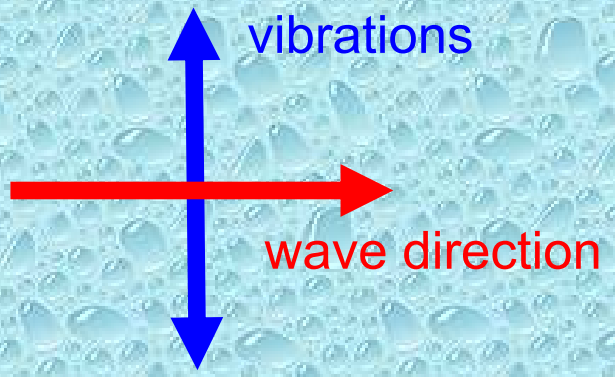
PROPERTIES OF WAVES

Waves

A wave is a means of transferring energy and information from one point to another without there being any transfer of matter between the two points.

Transverse Waves

Transverse waves are waves where the direction of vibrations is at 90° to the direction in which the wave travels.

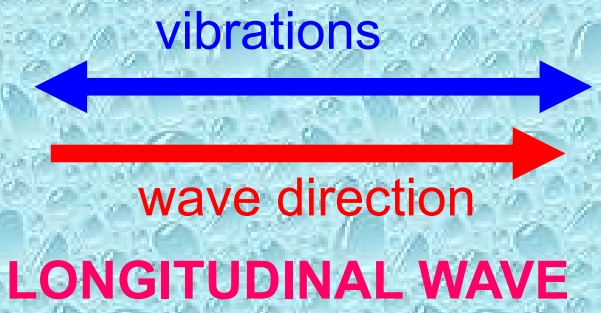


TRANSVERSE WAVE

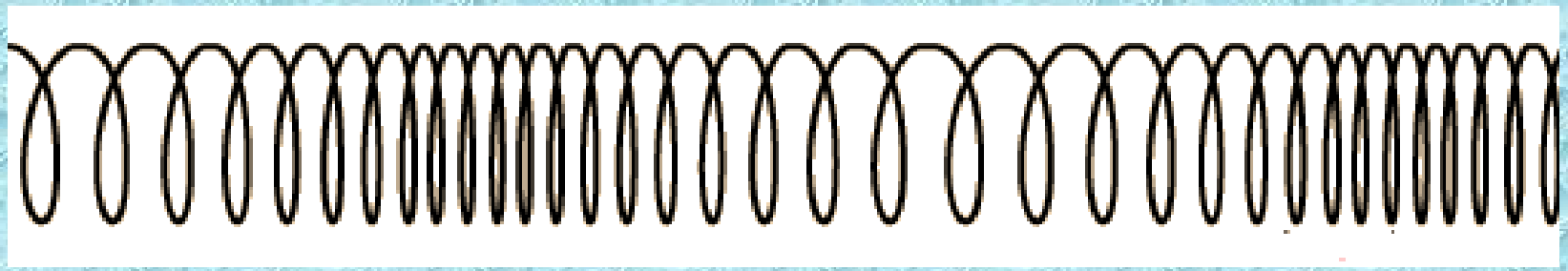
example: water waves

Longitudinal Waves

Longitudinal waves are waves where the vibrations of the particles are along the direction in which the wave travels.



example: sound waves

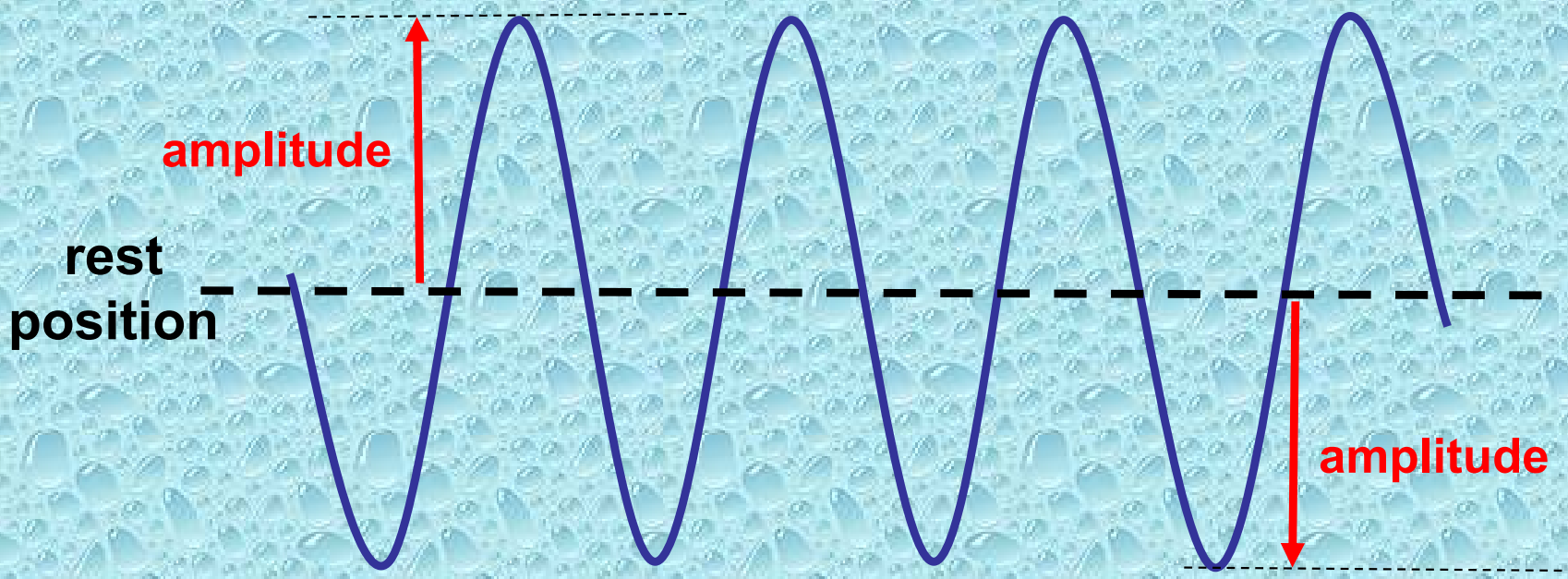


longitudinal wave in slinky

Describing Waves

1. Amplitude (*A*)

Amplitude is the maximum movement of the particles that make up a wave from their rest position.

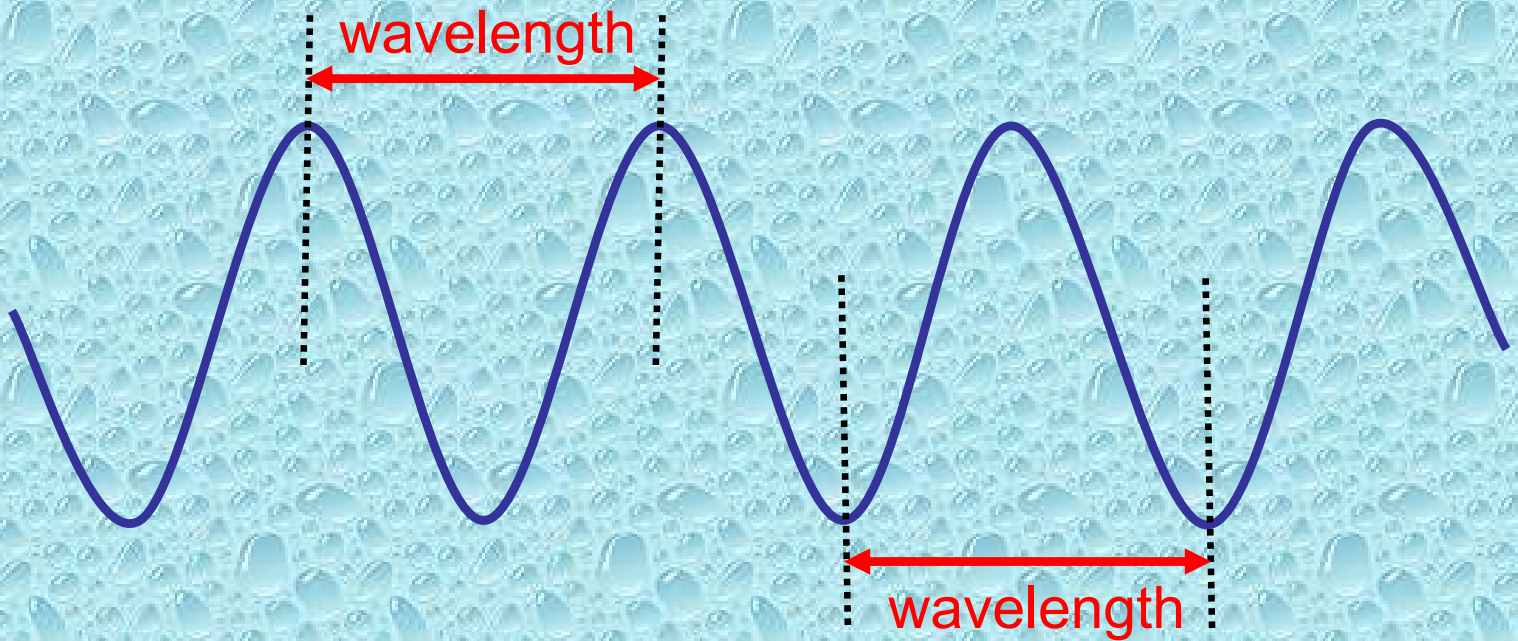


The amplitude is the height of a crest OR the depth of a trough

2. Wavelength (λ)

Wavelength is the distance between one wave peak and the next wave peak along the path of a wave.

Wavelength is measured in **metres.**



Wavelength is also the distance between the bottom of one trough to the next.

3. Frequency (*f*)

Frequency is the number of wave peaks that pass a point in one second.

Frequency is measured in hertz (Hz)

1 Hz = 1 peak per second

2 Hz = 2 peaks per second *and so on….*

1 kilohertz (1kHz) = 1 000 Hz

1 megahertz (1MHz) = 1 000 000 Hz

1 gigahertz (1GHz) = 1 000 000 000 Hz

1 terahertz (1THz) = 1 000 000 000 000 Hz

4. Time period (*T*)

Time period is the time taken for a source to produce one wave.

$$\text{time period} = \frac{1}{\text{frequency}}$$

$$T = 1 / f$$

and:

$$\text{frequency} = \frac{1}{\text{time period}}$$

$$f = 1 / T$$

Question 1

Calculate the frequency of a wave of time period 8.0 seconds.

f* = *1* / *T

= 1 / 8

frequency = 0.125 hertz

Question 2

Calculate the time period of a wave of frequency 50Hz.

T* = *1* / *f

= 1 / 50

time period = 0.020 second

The wave equation

speed = frequency x wavelength

$$v = f \times \lambda$$

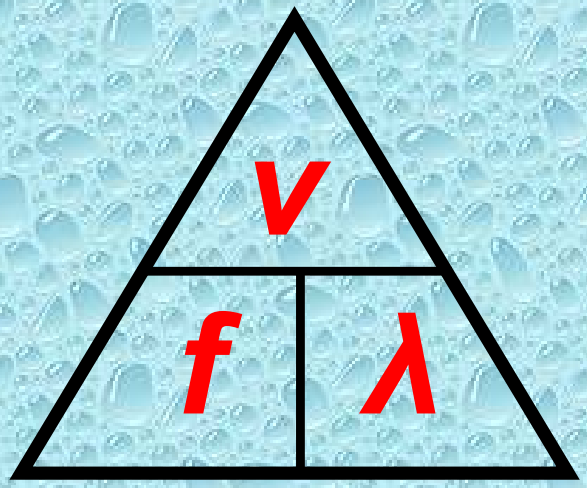
speed in metres per second (m/s)

wavelength in metres (m)

frequency in hertz (Hz)

also: $f = v \div \lambda$

and: $\lambda = v \div f$



Question 1

Calculate the speed of a water wave of wavelength 3m and frequency 6Hz.

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Calculate the speed of a water wave of wavelength 3m and frequency 6Hz.

$v = f \times \lambda$

= 6Hz x 3m

speed = 18 m/s

Question 2

Calculate the frequency of a wave in water of wavelength 2.0m if its speed is 16m/s.

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Calculate the frequency of a wave in water of wavelength 2.0m if its speed is 16m/s.

$v = f \times \lambda$

becomes:

$f = v \div \lambda$

= 16 m/s ÷ 2m

frequency = 8 Hz

Question 3

Calculate the wavelength of a sound wave in water of frequency 300Hz if its speed is 1500m/s.

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Calculate the wavelength of a sound wave in water of frequency 300Hz if its speed is 1500m/s.

$v = f \times \lambda$

becomes:

$\lambda = v \div f$

= 1500 m/s ÷ 300 Hz

wavelength = 5 metres

Question 4

Calculate the speed of a wave that has a wavelength of 30m and time period 0.04s.

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Calculate the speed of a wave that has a wavelength of 30m and time period 0.04s.

$f = 1 / T$

= 1 / 0.04s

f = 25 hertz

$v = f \times \lambda$

= 25Hz x 30m

speed = 750 m/s