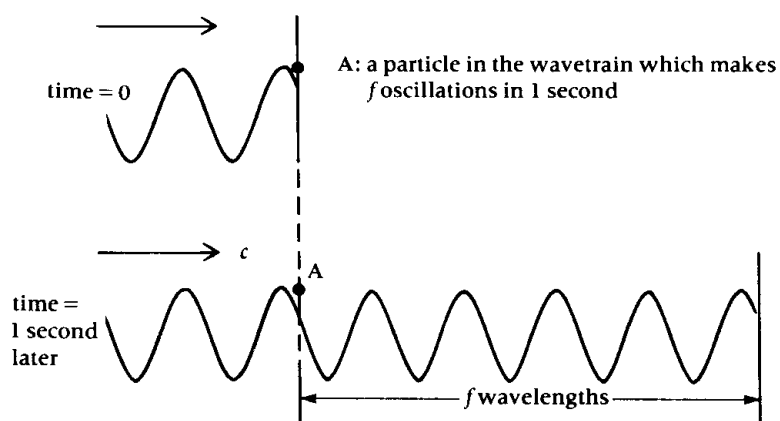


A WAVE EQUATION

A vibrator of frequency, f (e.g. 5Hz) produces waves of wavelength λ (e.g. 2m). Consider the following:



If the frequency is 5Hz then in one second 5 waves are produced.

Each wave has a wavelength of 2m.

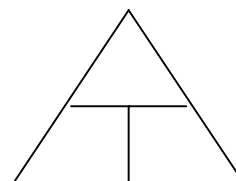
In one second the wave travels 5 wavelengths i.e. 10m.

Therefore the wave-speed must be 10m/s.

A general formula for wave-speed is:

$$\text{wave-speed} = \text{frequency} \times \text{wavelength}$$

$$v = f \times \lambda$$



Examples

A boy throws a stone into a pond. The ripples that are produced have a frequency of 3Hz. They also have a wavelength of 5cm. What is the speed of the waves in cm/s?

Formula	Working	Answer	Unit
	$v = f \times \lambda$		
	$v = 3 \times 5$		
	$v = 15\text{cm/s}$		

A straight vibrator causes water ripples to travel across the surface of a shallow tank. The waves travel a distance of 30cm in 1.5s and the distance between successive wave crests is 4.0cm. Calculate the frequency of the vibrator.

$\text{speed} = \frac{\text{distance}}{\text{time}}$	$f = \frac{v}{\lambda}$
$\text{speed} = \frac{30}{1.5}$	$f = \frac{20}{4}$
$\text{speed} = 20\text{m/s}$	$f = 5\text{Hz}$

Questions

Answer the following questions making sure that you show all your working.

1. A vibrating bar sends 8 ripples per second across a water tank. The ripples are seen to be 5cm apart. Calculate the wave-speed in cm/s.

.....
.....

2. A person holds the end of a slinky spring and sends some transverse waves along the spring.

(a) Describe how the person is moving their hand.

.....
.....

- (b) The waves have a frequency of 2Hz. Calculate the wavelength if the speed of the waves is 0.5m/s.

.....
.....

3. Waves enter a harbour at a rate of 30 crests per minute. A girl watches a particular wave crest passing two posts which are 6 metres apart along the direction of travel of the waves. The time from one post to the other is 2 seconds. Calculate:

(a) the frequency of the wave motion

.....
.....

(b) the wavelength of the waves

.....
.....