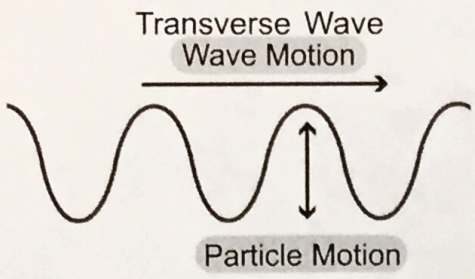
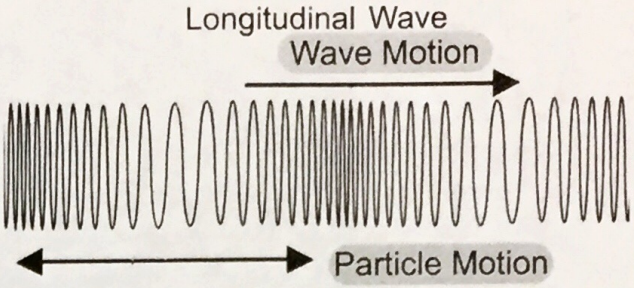
Waves: Introduction and Types

Instructions: Read through the information below. Then complete the statements at the bottom of the page using the BOLD words from the page.

A wave is a transfer of energy through a medium from one point to another. Some examples of waves include; water waves, sound waves, and radio waves. Waves come in two different forms; a **Transverse** Wave which moves the medium *perpendicular* to the wave motion, and a **Longitudinal** Wave, which moves the medium *parallel* to the wave motion.



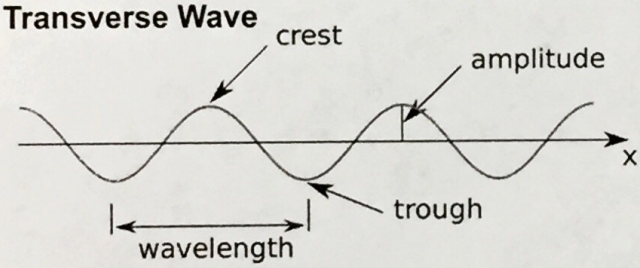


Examples of Transverse waves would be a vibrating guitar string or electromagnetic waves, while an example of a Longitudinal wave would be a "Slinky" wave that you push and pull.

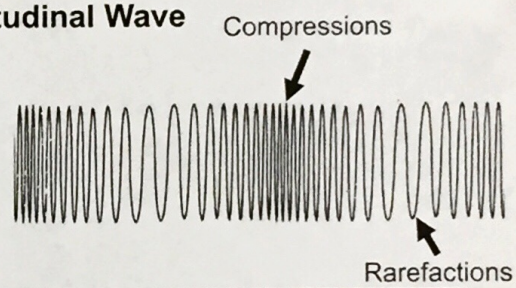
Waves have several properties which are represented in the diagrams below. In a Transverse wave the **Crest** and Troughs are the locations of maximum displacement up or down. The **Amplitude** is the measurement of maximum displacement. The **Wavelength** is the distance of one complete wave cycle. For example; the distance from crest to crest or trough to trough would be 1 wavelength.

In a Longitudinal wave, areas of maximum displacement are known as **Compressions** and **Rarefactions**. The stronger the wave, the more compressed and spread out the wave medium becomes.

Transverse Wave



Longitudinal Wave



Fill in the statements using the BOLD words from the above information.

1- Wave motion that is Parallel to wave direction describes a _____ wave.

2- A _____ is the maximum upwards displacement in a Transverse wave.

3- One complete wave cycle is referred to as a _____.

4- Wave motion that is Perpendicular to wave direction describes a _____ wave.

5- A _____ or _____ is the maximum displacement in a Longitudinal wave.

6- An Ocean wave would be an example of a _____ wave.

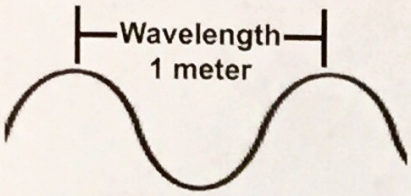
7- The distance from one trough to another trough is called a _____.

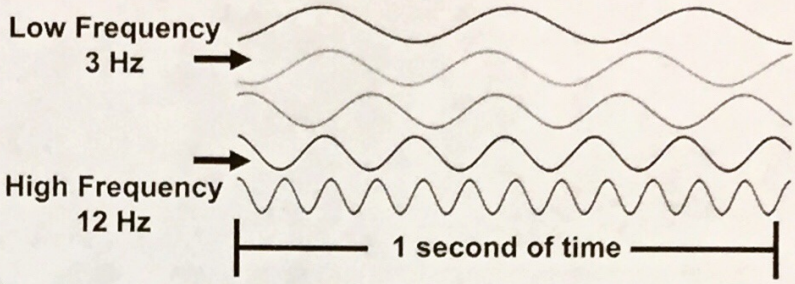
8- The measurement of displacement is called a wave's _____.

Waves: Velocity and Frequency

Instructions: Read through the information below. Then complete the calculation problems at the bottom of the page.

The velocity of a wave can be calculated if you have enough information. First you need to know the *Wavelength*, or the length of one complete wave cycle. This could be measured Crest to Crest, Trough to Trough, or any other complete cycle of a wave. The second aspect you need is the wave *Frequency*, or the number of waves or vibrations produced per second. The frequency is measured in Hertz and the Wavelength is measured in meters.





The equation for calculating the velocity of a wave is:

Velocity = Wavelength x Frequency $v = \lambda \times f$

This equation works for any wave form, water, sound, or radio waves.

EXAMPLE: A wave as a Wavelength of 5 meters and a Frequency of 10 Hz.
What is its velocity?

V = 5 x 10 → V= 50 meters per second

Solve using the wave velocity equation: *(Show your equation set up and math work)*

1- A wave has a Wavelength of 12 meters and a Frequency of 10 Hz.
What is its velocity?

2-A wave has a Wavelength of 3 meters and a Frequency of 15Hz.
What is its velocity?

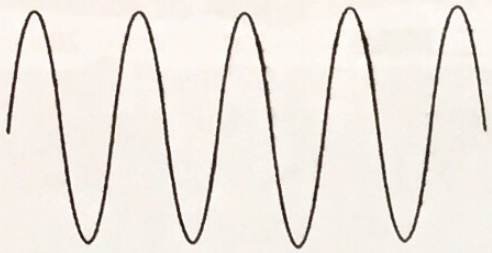
3-A wave has a Wavelength of 18 meters and a Frequency of .5 Hz.
What is its velocity?

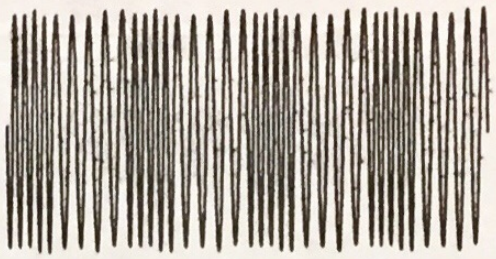
4- A wave has a Wavelength of .5 meters and a Frequency of 100 Hz.
What is its velocity?

WAVE PROPERTIES

[redacted]

1 Diagrams A & B each represent waves.

A 

B 

(a)

(i) What type of wave does diagram A represent? _____

(ii) What type of wave does diagram B represent? _____

(iii) How many cycles of the wave are shown in diagram A? _____

(iv) How many cycles of the wave are shown in diagram B? _____

(b) Which diagram would you use to represent

(i) a wave travelling across the surface of water _____

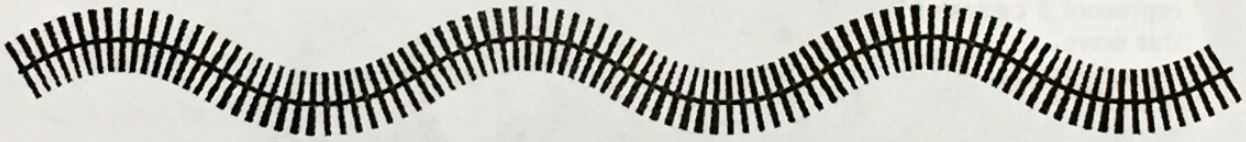
(ii) an acoustic wave (i.e. sound) _____

(iii) an electromagnetic wave _____

(iv) a transverse wave travelling through a slinky _____

2 The diagrams below are of a slinky that has been stretched between two points. Diagram A shows the slinky before a wave travels though it. Diagram B shows the slinky at some instant as a wave travels through it. The speed of the wave is 4 m/s.

A 

B 

(i) What type of wave is travelling through the slinky? _____

3 The diagrams below are of a slinky that has been stretched between two points. Diagram A shows the slinky before a compressive wave travels though it. Diagram B shows the slinky at some instant as a wave travels through it.

A 

B 

(a) What type of wave is travelling through the slinky in this example? _____

(i) Each compression takes 1.5 seconds to travel from one end of the slinky to the other. Use *speed = distance / time* to calculate at what speed is the wave moving through the slinky?

_____

(ii) What is the wavelength of the wave travelling through the slinky?

_____

(iii) use your answers to (i) and (ii) to calculate the frequency of the wave in this example.

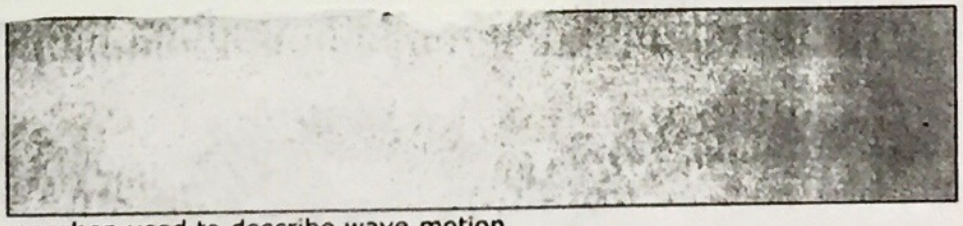
_____

_____

(b) The rate of the vibration causing the compression waves is increased. It still takes 1.5 seconds for a compression to travel through the slinky. How, if at all does the frequency and wavelength of the wave through the slinky change from the situation described in part (a)

frequency _____

wavelength _____



(b) Explain the following terms when used to describe wave motion

(i) wavelength _____

_____