7. Identify each of the following terms:

a) amplitude — maximum displacement from the equilibrium position

b) wavelength — shortest distance along the wave between two points that are in phase

c) period — time taken for one cycle

d) frequency — number of cycles per second

Symbol	Units
A	[m]
λ	[m]
T	[s]
f	$(\frac{1}{s}) = [Hz]$

8. What is the relationship between period and frequency?

Period

$T = \frac{\text{seconds}}{\text{cycle}}$

Frequency

$f = \frac{\text{cycles}}{\text{second}}$

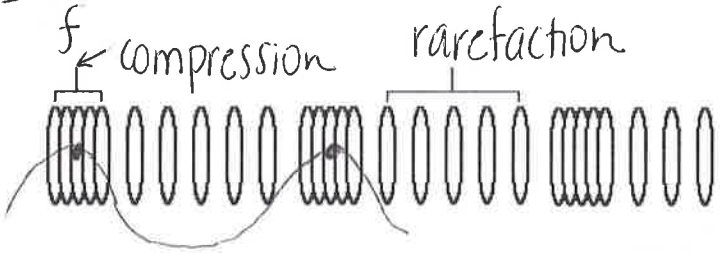
Relationship

$f = \frac{1}{T}$ or $T = \frac{1}{f}$

Examples:

$T = 2s \quad f = \frac{1}{2s} = 0.5Hz$

9. Name each part of the longitudinal wave shown at right. Indicate the amplitude and wavelength of the wave.

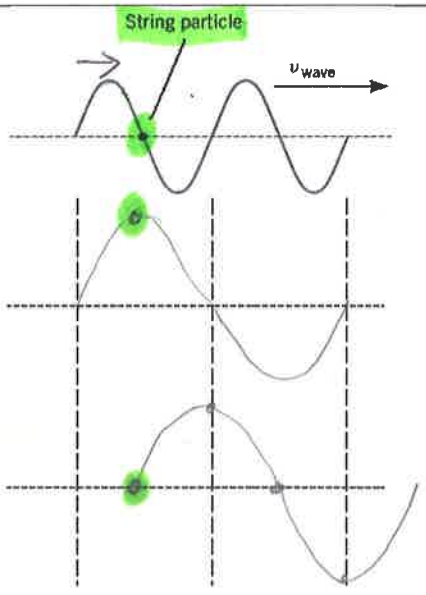


Wave Motion vs. Particle Motion

a) In which direction is the string particle moving at this instant?

b) Sketch the wave and particle after ¼ of a period from the time shown in a).

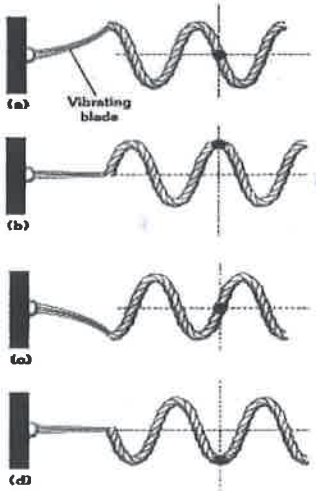
c) Sketch the wave and particle after ½ of a period from the time shown in a).



d) How far will the wave energy travel in one period? one wavelength

e) How long does it take one complete cycle to pass a given point? one period

Compare the motion of the wave with the motion of a single particle of the medium.



Wave (energy) motion
constant speed in the horizontal direction

Particle motion
simple harmonic motion (SHM)

In a full period = 4 amplitudes in the vertical direction

Determining the Speed of a Wave

The Wave Equation $V = \lambda f$

Derivation

$V = \frac{d}{t}$

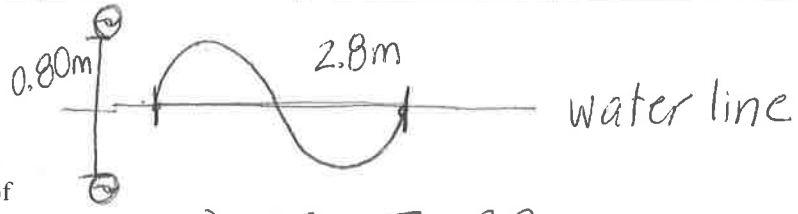
$V = \frac{\lambda}{T} \left[\frac{m}{s}\right]$

$T = \frac{1}{f}$

$V = \lambda f \left[m \cdot \frac{1}{s}\right]$

Variable:	V (or c)	λ	f
Quantity:	speed	wavelength	frequency
Units:	[m/s]	[m]	$\left(\frac{1}{s}\right) = [Hz] = s^{-1}$
Type:	scalar	scalar	scalar

1. A buoy moored off-shore bobs up and down as waves pass by. A nearby boater notices that it takes 1.6 seconds for the buoy to move from its lowest position to its highest position, a distance of 0.80 meters. She also notices that the crests of the waves are approximately 2.8 meters apart.



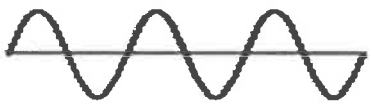
$\lambda = 2.8m \quad T = 3.2s$

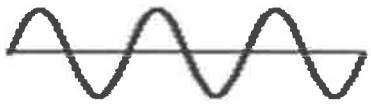
a) What is the average speed of the buoy?

$V = \frac{d}{t} = \frac{0.80m}{1.6s} = \boxed{0.50 \frac{m}{s}}$

b) What is the average speed of the wave?

$V = \lambda f = (2.8m)\left(\frac{1}{3.2s}\right) = 0.875 \frac{m}{s}$





$\boxed{0.88 \frac{m}{s}}$

2. a) On the bottom, sketch a wave that has the same wavelength as the wave on top but a higher amplitude.

   b) A mechanical wave with a higher amplitude has more . . .

   c) Will increasing the amplitude change the speed of the wave?

3. a) On the bottom, sketch a wave that has the same amplitude as the wave on top but a higher frequency.

   b) A wave with a higher frequency has a . . .

   c) Will increasing the frequency change the speed of the wave?

4. How can the speed of a wave be changed?