Physics 100 Name: Answers

Mechanical Waves Notes

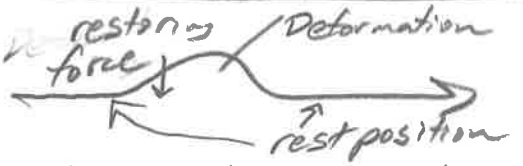
Wave: an oscillation that travels through space, transferring energy.

Oscillation: a back and forth movement; a vibration

Types of Waves and Wave Terminology:

Mechanical Wave: A deformation traveling through matter

Deformation: Matter shifting away from its resting position



Restoring force: returns deformed matter to resting position

Examples of restoring forces: ~~Water waves gravity~~ slinky tension ~~sound waves air pressure~~

Examples of Mechanical Waves:

water waves, slinky, sound, earthquake waves

Electromagnetic Wave: Oscillating electric and magnetic fields, traveling through space. No matter is required

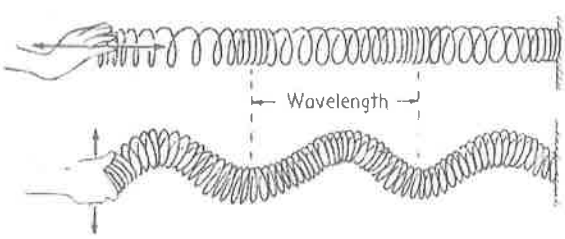
Examples of Electromagnetic waves: radio, microwaves, infrared, visible light, U.V., x rays, gamma rays

Transverse and Longitudinal waves:

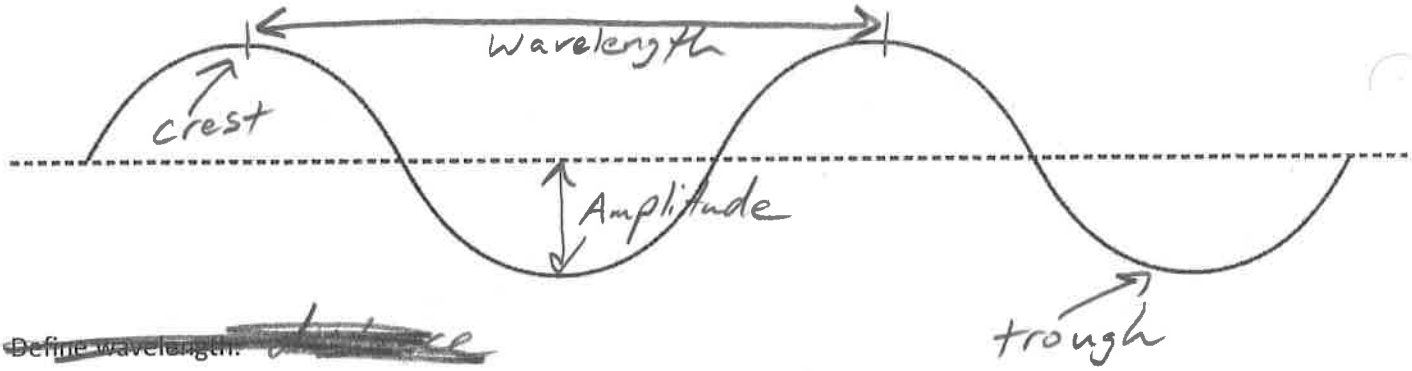
What is the primary difference between transverse waves and longitudinal waves?

Transverse Wave (a): Oscillations parallel to movement

Longitudinal Wave – a.k.a. "compression waves" (b): Oscillations perpendicular to movement

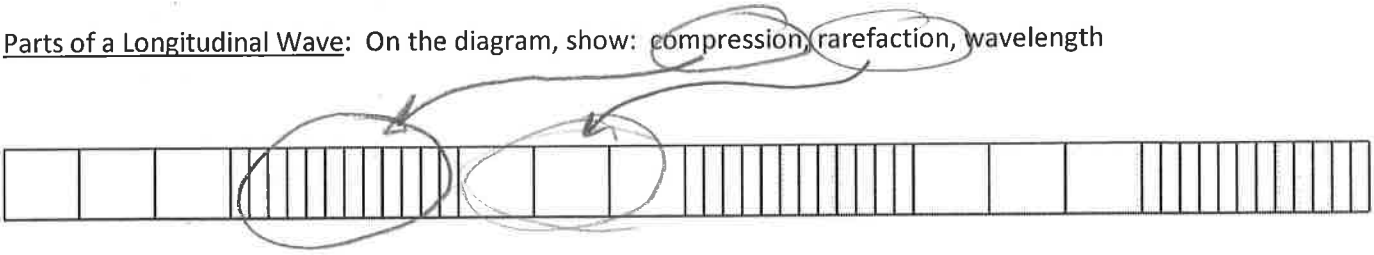


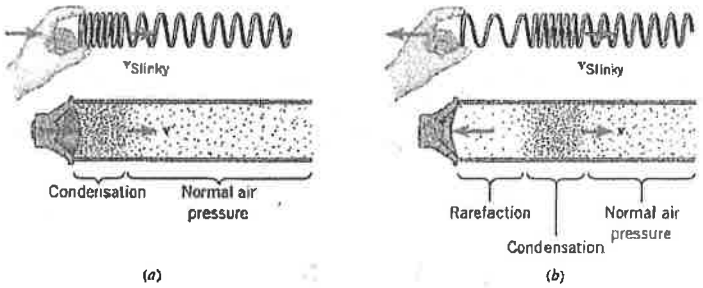
Parts of a Transverse Wave: On the diagram of the transverse wave, show: crest, trough, wavelength, amplitude



Define wavelength: distance

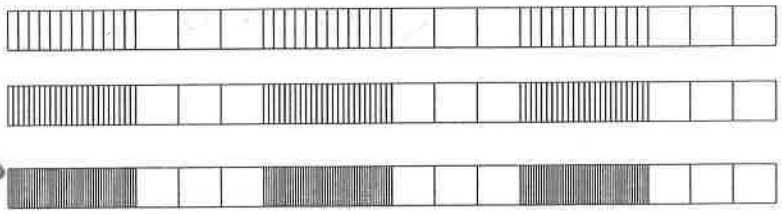
Parts of a Longitudinal Wave: On the diagram, show: compression, rarefaction, wavelength





What determines the amplitude of a longitudinal wave? Tightness of compression

Which of the series of waves on the right shows the greatest amplitude?



Sound waves are longitudinal, but they can be represented as transverse waves:

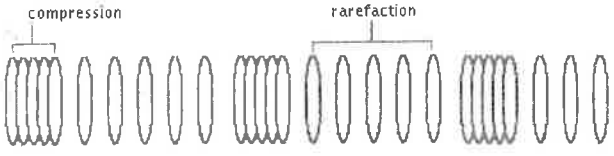


Figure 1: Longitudinal Wave

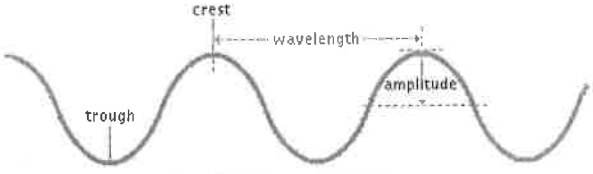
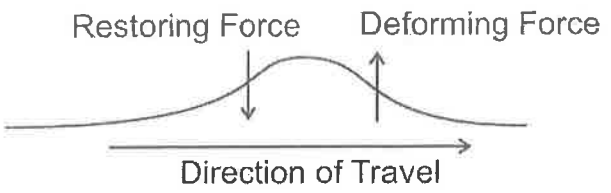


Figure 2: Transverse Wave

Identifying restoring forces in mechanical waves:



A student shakes the end of a slinky, sending waves along its length:

Initial Deformation force: Student's shake

Restoring force: Spring tension pulls it back

A balloon pops, sending sound waves through air:

Initial Deformation force: Outward explosion of air

Restoring force: Air pressure -- compressed air spreads back out

A swimmer jumps into a swimming pool, creating a wave:

Initial Deformation force: Student pushes some water down, forcing other water up.

Restoring force: Gravity pulls waves back down

Period and Frequency

Period: Seconds per wave

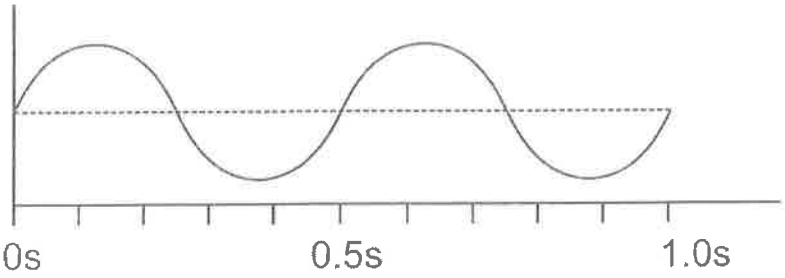
Frequency: Waves per second

Symbol for frequency: f

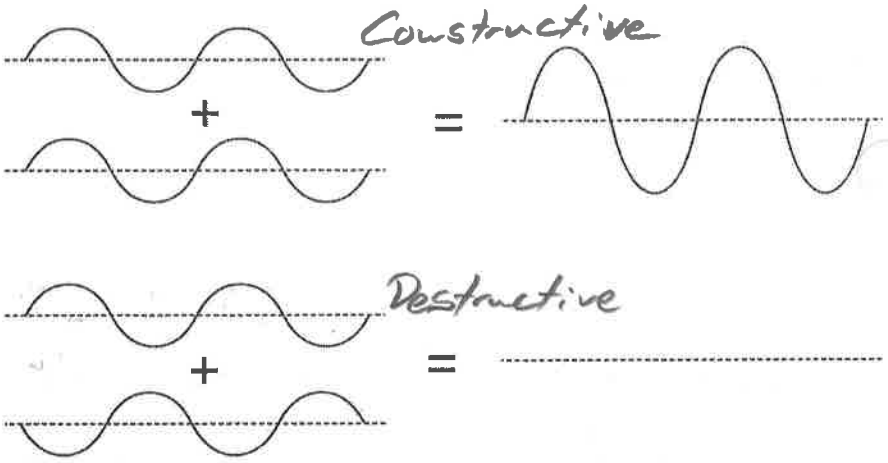
Units for frequency: hertz (hz)

What is the period of the waves below? 0.5s

Calculate the frequency of those waves. $f = \frac{1}{T} = 2hz$



Wave Interference: When two waves overlap one another, their oscillations can add to one another, or they can diminish one another. Label the examples of interference on the right.



Wave Interference can cause "**beats**". When two waves have slightly different frequencies, their interference alternates between constructive and destructive. The diagram below shows transverse representations of two sound waves (channels 1 and 2) and their resultant sound (channel 3).

1. In the diagram, label the channel with the highest frequency (1 or 2).
2. Then label regions of constructive and destructive interference. Channel 3 is the "sum" of channels 1 and 2.
3. Label the "beats" that will be heard