Physics 200 (Stapleton) Name: _____

Notes: Waves and Sound, Part 2

Give some examples of waves.

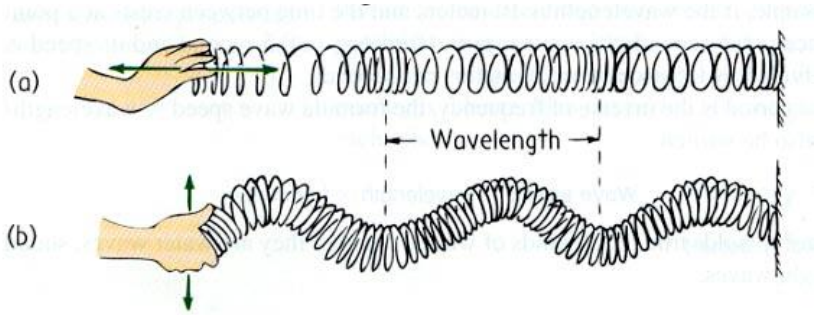
Transverse and Longitudinal Waves

A. A transverse wave (a.k.a. shear wave, sinusoidal wave) is a disturbance _____ to the direction of propagation.

B. A longitudinal wave (or compressional wave) is a disturbance _____ to the direction of propagation.

Types and parts of waves:

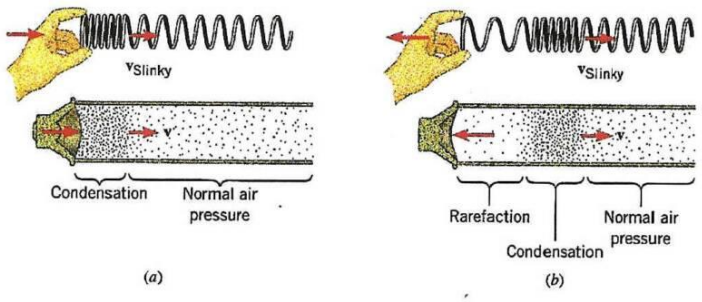
Identify the two different types of waves on the right.



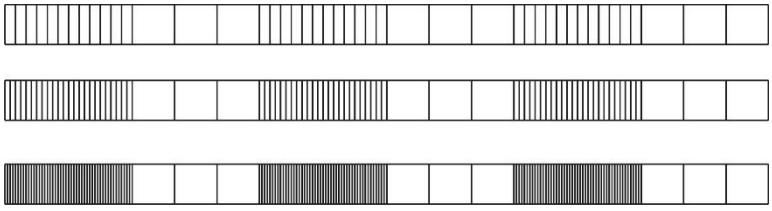
Parts of a longitudinal wave: compression, rarefaction, wavelength

What determines the amplitude of a longitudinal wave?

Formation of a sound wave (longitudinal wave, a.k.a. compression wave)



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:

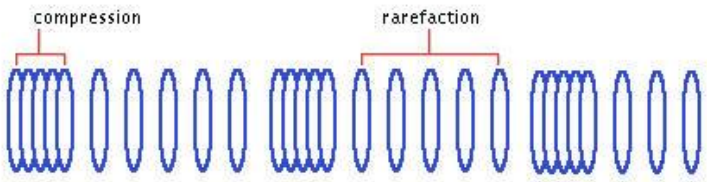


Figure 1: Longitudinal Wave

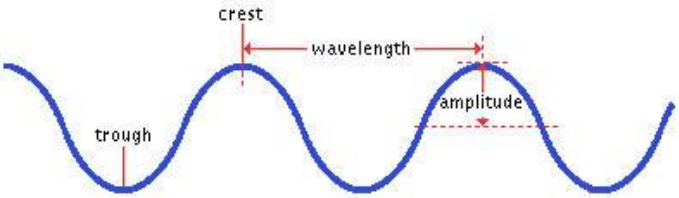
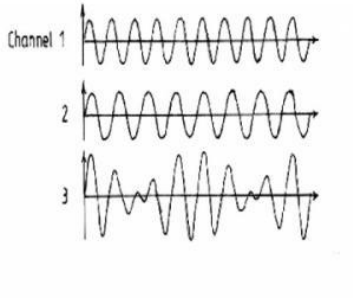


Figure 2: Transverse Wave

<u>Reviewing Interference</u>:

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).



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

Beat frequency =difference in frequencies of two notes that are played together
Example: What is the beat frequency when 220Hz and 216Hz are played at the same time? _____

<u>Standing Waves Revisited:</u>

What are some rules for drawing standing waves?

1.

2. If an end is free to move, it is a(n) _____. If an end is fixed, it is a(n) _____.

Draw a vibrating string with the combinations of nodes and antinodes below. Label the free and fixed ends.

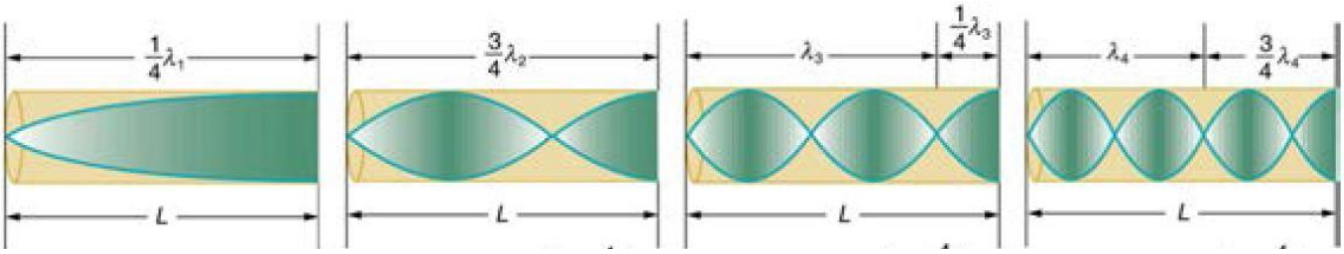
- 3 nodes, 2 antinodes

- 4 nodes, 4 antinodes

- 2 nodes, 3 antinodes

Standing Sound Waves in a Tube

Wavelengths and Harmonics in a tube **open at one end** (e.g. an organ pipe)



1. How are waves in an organ pipe different than waves on a string?

2. The diagram above represents the organ pipe waves as transverse waves. In reality, they are longitudinal. What is really happening to air molecules at the antinodes?

3. At the nodes, what are the air molecules doing?

4. For the fundamental, explain why there is a node at the left end and an antinode at the right?

5. Draw the fundamental for a pipe that is closed at both ends. How much of a wavelength does the pipe length represent?

6. For each harmonic above, write an equation for wavelength in terms of tube length.

7. Label any harmonics according to the order of the harmonic (i.e. 1st harmonic, 2nd harmonic, 3rd harmonic…). The lowest frequency harmonic is the **1st harmonic (a.k.a fundamental)**. The **nth harmonic** has a wavelength that is equal to the fundamental wavelength/n.

8. Label the harmonics using the term "overtone," rather than the term harmonic.