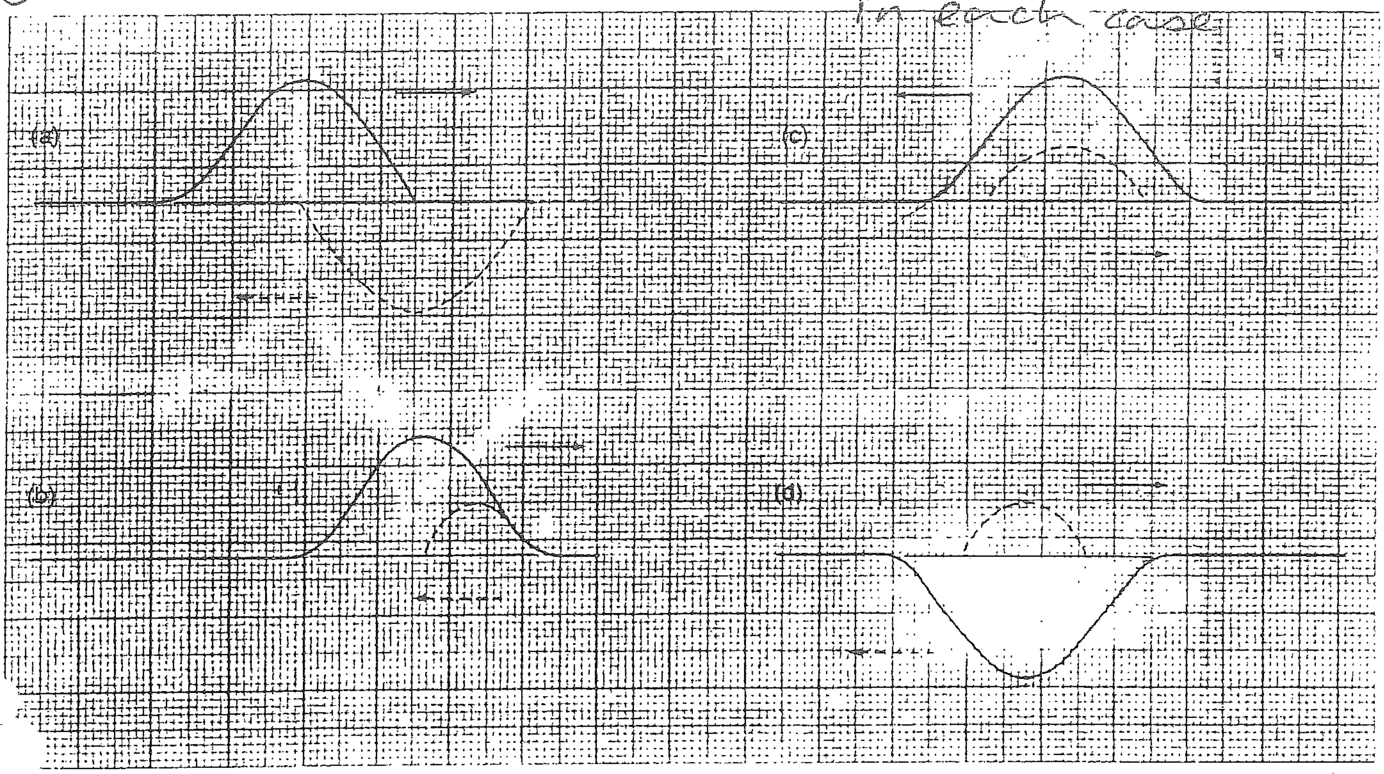
Physics 11 Worksheet – wave interference + superposition

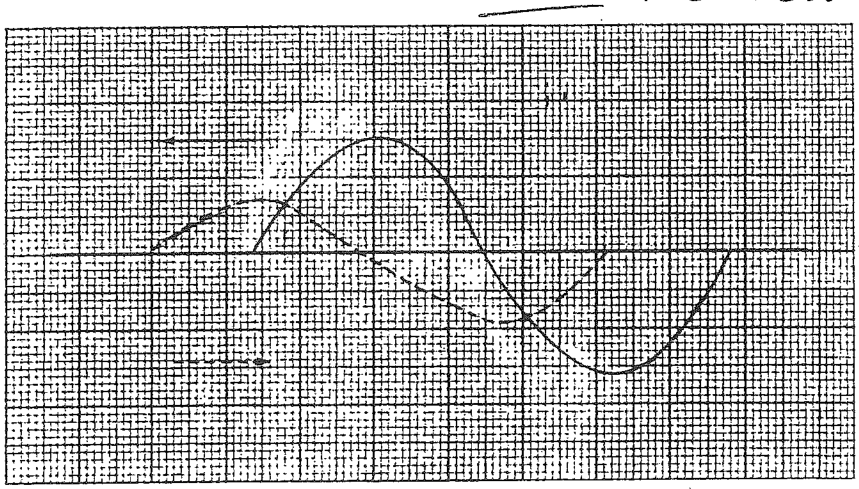
(1)

0. ~~Trace the pulses illustrated into your notebook, and~~ determine the resultant displacement of the particles of the medium at each instant, using the Principle of Superposition. (draw the resultant wave) in each case

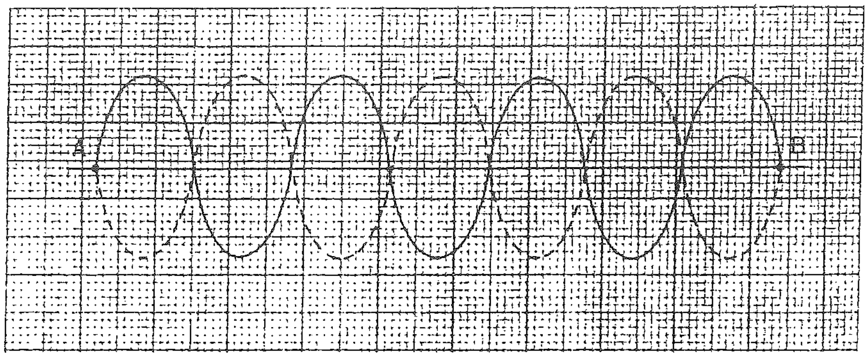


(2)

~~31. Trace the waves illustrated into your notebook and~~ determine their resultant displacement. Draw the resultant wave.



32.



Using measurements taken directly from this diagram of a standing wave pattern, determine each of the following.

(a) the wavelength of the waves

(b) the speed of the waves, if they move between points A and B in 3.0 s

(c) the frequency of the waves

33. Calculate the wavelength if the distance between adjacent nodes in a vibrating medium is

(a) 1.5 m (b) 4.0 cm (c) 48 mm

34. The distance between adjacent nodes in the standing wave pattern in a piece of string is 25.0 cm.

(a) What is the wavelength of the wave in the string?

(b) If the frequency of the vibration is 200 Hz, calculate the velocity of the wave.

35. Standing waves are produced in a string by sources at each end with a frequency of 10.0 Hz. The distance between the third node and the sixth node is 54 cm.

(a) What is the wavelength of the interfering waves?

(b) What is their speed?

36. Standing waves are produced in a string by two waves travelling in opposite directions at 6.0 m/s. The distance between the second node and the sixth node is 80 cm. Determine the wavelength and the frequency of the original waves.

37. In the middle of a page in your notebook, mark two points 4.0 cm apart. Using a compass, draw in circular wavefronts originating at the points with 2.0 cm wavelengths. Use solid lines for crests and dotted lines for troughs. Mark all the nodes and points of maximum constructive interference.

Name: ______________________

Block:: ______

Boundary Behavior

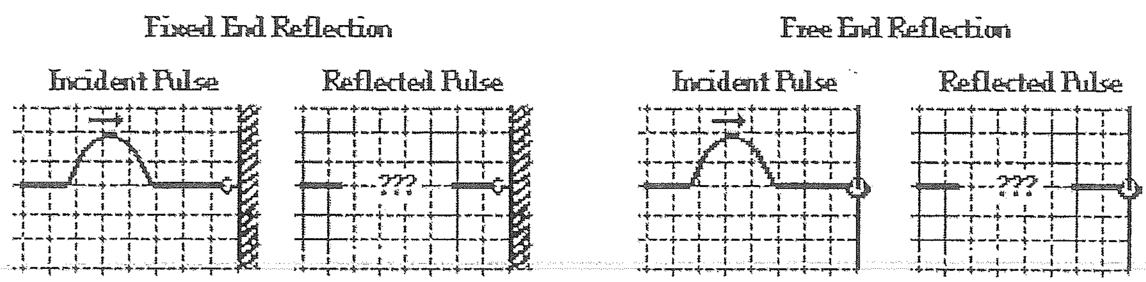
Background:

The behavior of a traveling wave (or pulse) upon reaching the end of a medium is referred to as boundary behavior. When one medium ends, another medium begins; the interface of the two media is referred to as the boundary and the behavior of a wave at that boundary is described as its boundary behavior. A pulse that is approaching a boundary is referred to as the incident pulse. Upon reaching the boundary, a portion of the incident pulse will be reflected and remain in the same medium; and a portion of the incident pulse will pass into (or be transmitted into) the other medium which lies beyond the boundary. The portion of the pulse that is reflected is referred to as the reflected pulse and the portion that passes into the other medium is referred to as the transmitted pulse. A proper understanding of the boundary behavior of waves involves an ability to answer the following questions.

Fixed and Free End Reflection:

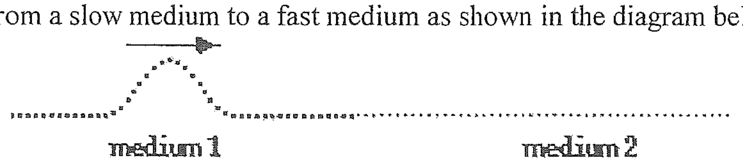
1. State the rule that describes how a pulse will behave at a free- and a fixed-end.

2. Express your understanding of reflection of waves at the end of a medium by drawing the size and orientation of the reflected pulse for the two cases below - reflection off a free end and a fixed end.



Reflection and Transmission of an incident Pulse at a Boundary Between Two Media:

A pulse is moving from a slow medium to a fast medium as shown in the diagram below.



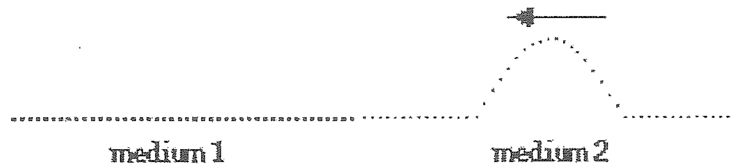
3. The reflected pulse in medium 1 ____________ (will, will not) be inverted because__________________
____

4. The speed of the transmitted pulse will be ___________ (greater than, less than, the same as) the speed of the incident pulse.

5. The speed of the reflected pulse will be ______________ (greater than, less than, the same as) the speed of the incident pulse.

6. The wavelength of the transmitted pulse will be ___________ (greater than, less than, the same as) the wavelength of the incident pulse.

A pulse is moving from a fast medium to a slow medium as shown in the diagram below.



7. The reflected pulse in medium 2 ____________ (will, will not) be inverted because ____________________

____

8. The speed of the transmitted pulse will be __________ (greater than, less than, the same as) the speed of the incident pulse.

9. The speed of the reflected pulse will be _____________ (greater than, less than, the same as) the speed of the incident pulse.

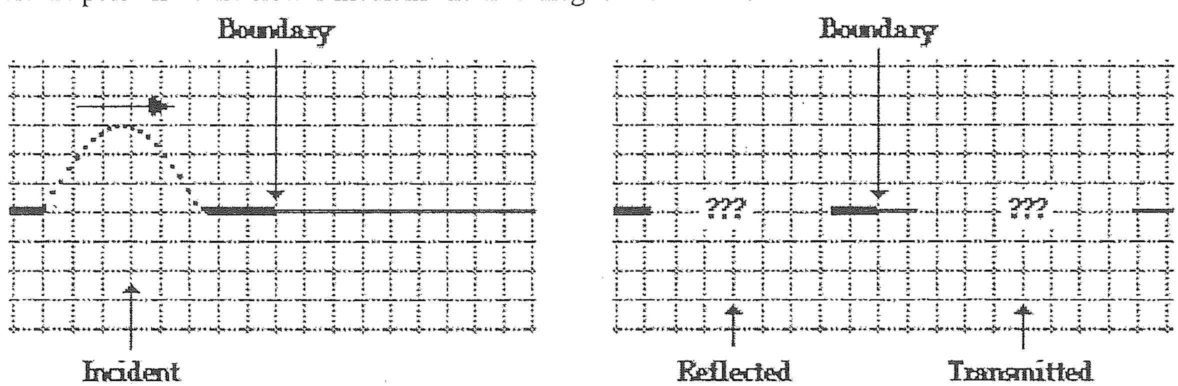
10. The wavelength of the transmitted pulse will be __________ (greater than, less than, the same as) the wavelength of the incident pulse.

11. Summarize your understanding of boundary behavior by completing the following statements.
When a wave passes across the boundary from one medium to another medium, the:

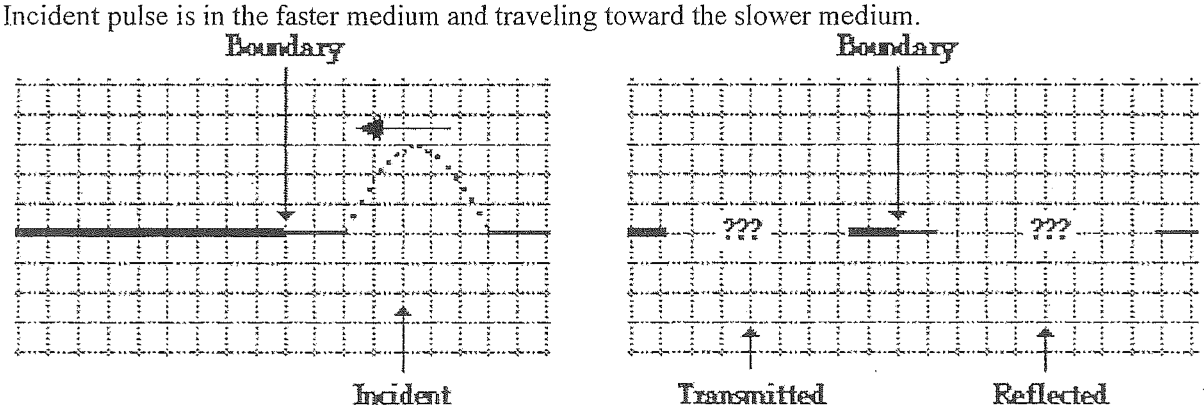
- wavelength is ______________ (greatest, smallest) in the faster media.
- the reflected pulse becomes inverted only when the incident wave is in the _________ (faster, slower) medium and heading toward the __________ (faster, slower) medium.

Express your understanding of the rules of boundary behavior by drawing the reflected and transmitted pulses in the following two situations. Show the orientation (inverted or non-inverted, wavelength and speed) of each pulse.

12. Incident pulse is in the slower medium and traveling toward the faster medium.



13. Incident pulse is in the faster medium and traveling toward the slower medium.

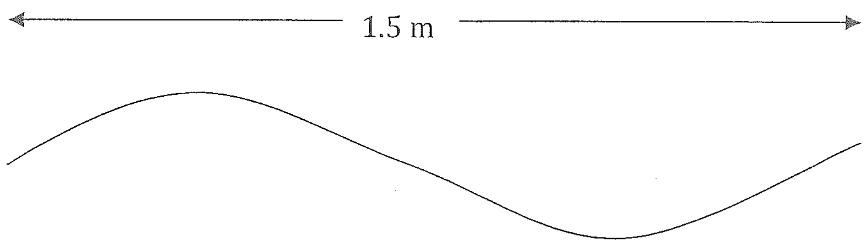


Physics 11/11H: Standing Waves Worksheet (Practice test)

Name: ______________________________

Show/explain all work, include diagrams, equations in symbols, appropriate significant digits, and unit.

1. A 1.5m long stretched string, fixed at both ends, is vibrated with a frequency of 585Hz. It vibrates as shown below:



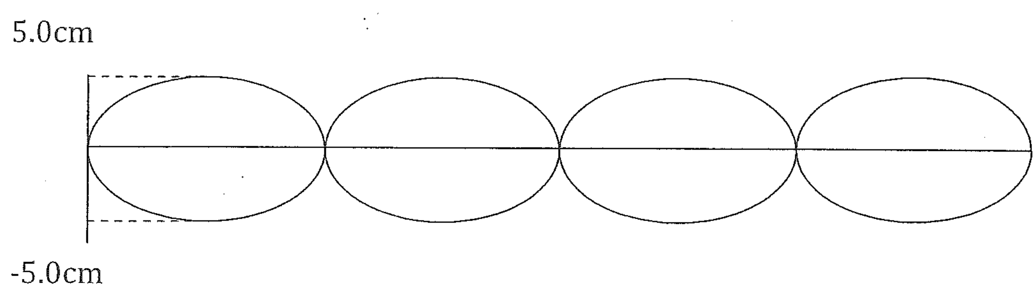
a) What is the speed of waves in the string?
b) What is the fundamental frequency of this string?

2. A string, fixed at both ends, is 85.0 cm long. If the speed of the waves is on the string is 13.00 m/s, what are the first three natural frequencies (harmonics) that can be produced by the spring?

3. Calculate the fundamental frequency sounded by a guitar string 105.0 cm long if the speed of sound in the string is 85.0 m/s?

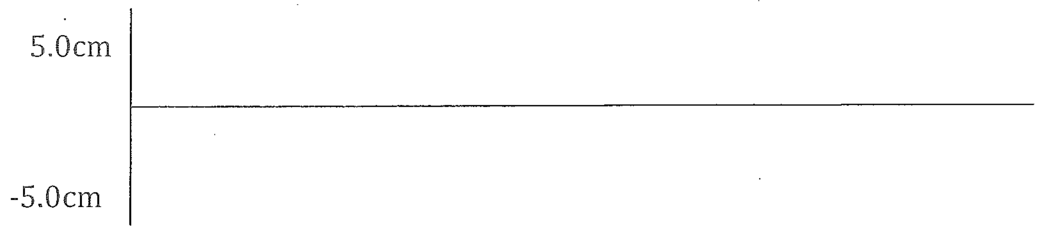
4. A standing wave is produced with a wavelength of 0.60m, and a speed of 3.0m/s, on a string 3.6m in length. Both ends of the string are fixed. How far from the end are the **first two** anti-nodes?

5. A standing wave pattern is produced on a 2.20m long string as shown. The frequency of the wave is 225 Hz.



a) What is the value of the amplitude of the wave?
b) What is the wavelength of the wave?
c) What is the speed of the wave?

d) Draw a diagram of what the wave would look like if the frequency were half the value.



6. What are the wavelengths of the 5 longest waves that can produce standing waves on a string of length 40.0 cm, fixed at both ends?

7. If the speed of the waves in a spring is 285 m/s, what are the frequencies that correspond with the wavelengths found in question 6?

8. What is the fundamental frequency sounded by a guitar string 60.0 cm long if the speed of sound in the string is 195 m/s?

9. A rope is fastened to a wall at one end. When the other end is shaken with a frequency of 20.0 Hz, a standing wave pattern occurs. If the speed of the waves in the rope is 35.0 m/s, how far away from the attached end are:
   a) the nearest antinode
   b) the nearest node (not the node at the fixed end, but the first node found along the rope, away from the wall)

10. The distance between adjacent nodes in a stretched string is 35.0 cm.
   a) If the frequency of vibration is 350.0 Hz, calculate the speed of the wave.
   b) If the frequency is reduced to 150.0 Hz, what is the new wavelength?