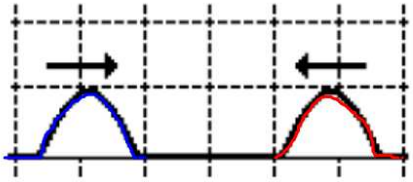
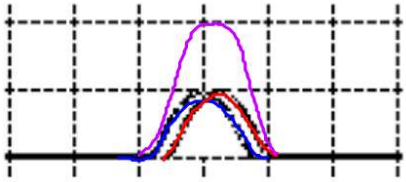
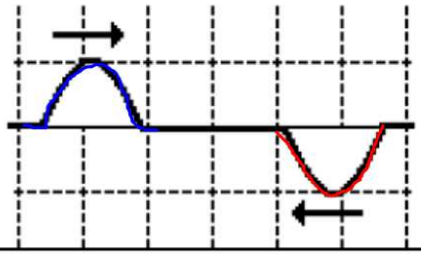
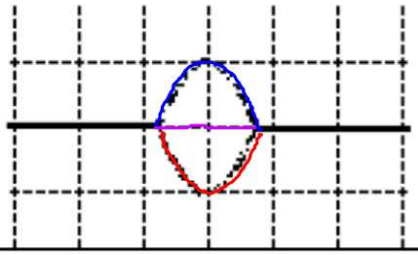
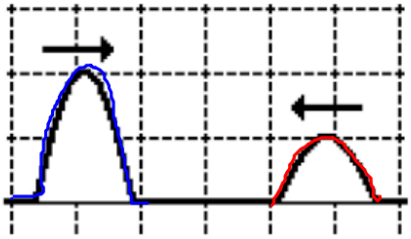
Principle of Superposition: The effect of two interfering waves upon a medium is to produce a resulting shape and size that is the combination of the shapes and sizes of the individual waves. The amount of displacement of the medium at any given location is simply the vector sum of the displacement of the two individual waves at that location.

8. The diagrams below depict two pulses traveling towards each other and at the moment when they are completely superimposed on each other. For each diagram, sketch the resultant of the two pulses during the interference. Finally, indicate if the example represents a case of constructive or destructive interference.

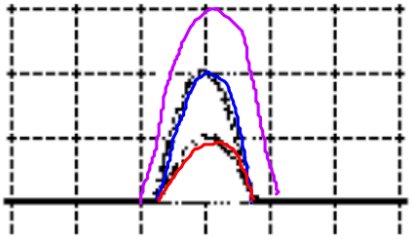
"Snapshot" of Two Pulses Before and During Interference	Constructive or Destructive?
BEFORE INTERFERENCE  DURING INTERFERENCE 	constructive
BEFORE INTERFERENCE  DURING INTERFERENCE 	destructive

--Continued from front side:

BEFORE INTERFERENCE

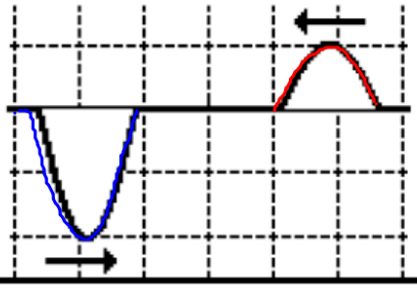


DURING INTERFERENCE

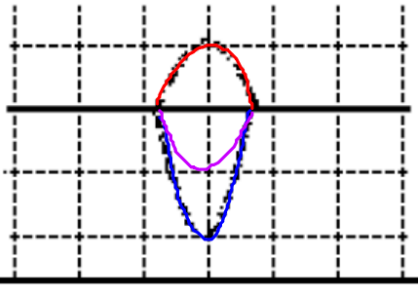


constructive

BEFORE INTERFERENCE



DURING INTERFERENCE



destructive

9. Two waves are traveling along the same medium. The diagrams below show the waves on the medium at an instant in time. Utilize the principle of superposition in order to construct the shape of the medium at the instant shown in each diagram. To do so, begin by determining the resulting displacement of the medium at each of the marked locations (↑). Approximate the shape of the remainder of the medium by sketching *from dot to dot*.

Diagram A

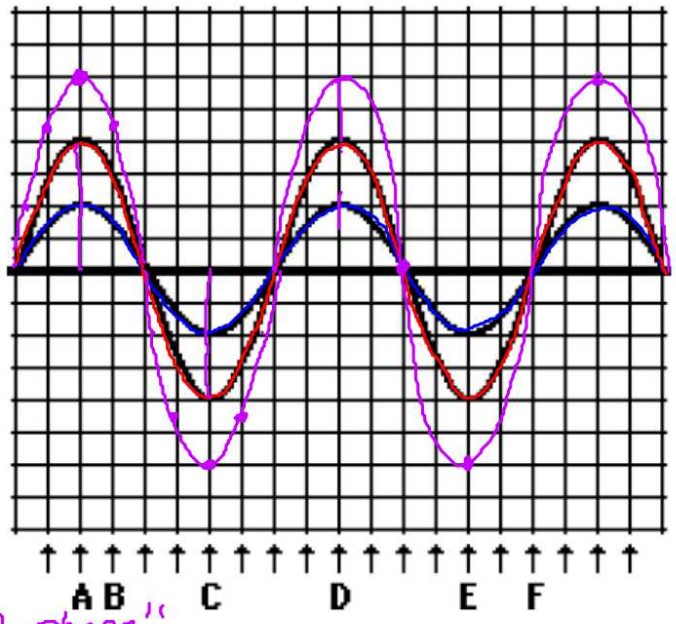
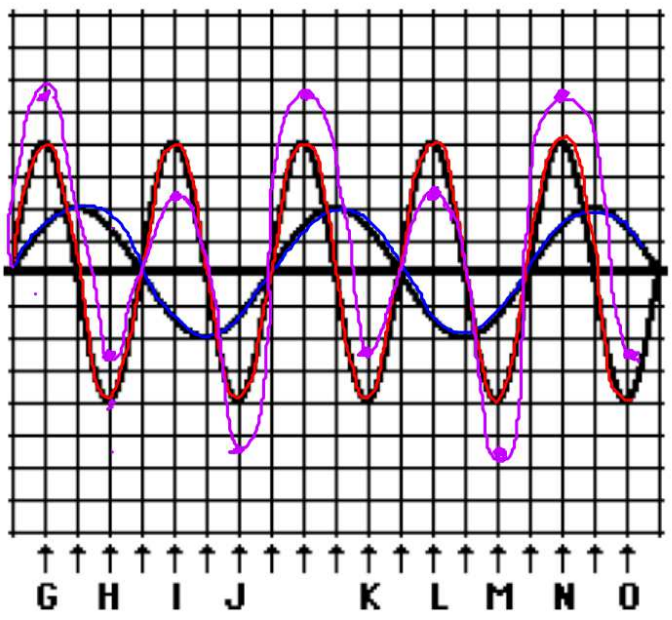


Diagram B



"in phase"

10. Several of the marked positions (↑) above are labeled with a letter. Categorize each labeled position along the medium as being a position where either constructive or destructive interference occurs.

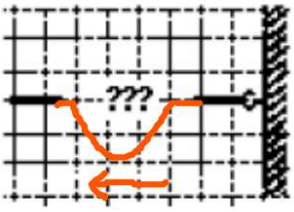
Constructive Interference	Destructive Interference
A, B, C, D, E, G, J, M, N	H, I, K, L, O

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.

Fixed End Reflection

Incident Pulse

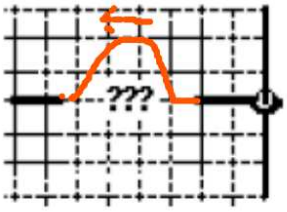
Reflected Pulse



Free End Reflection

Incident Pulse

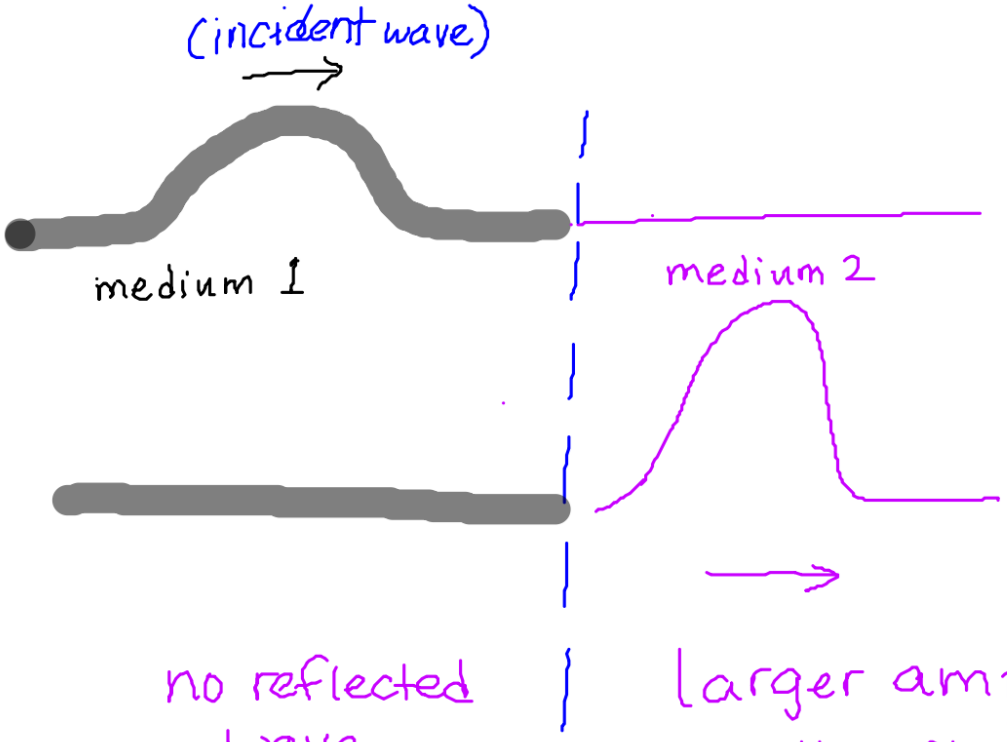
Reflected Pulse



Reflection and Transmission of an Incident Pulse at a Boundary Between Two Media:
A pulse is moving from a more dense medium to a less dense medium as shown in the diagram below.

medium 1 **medium 2**

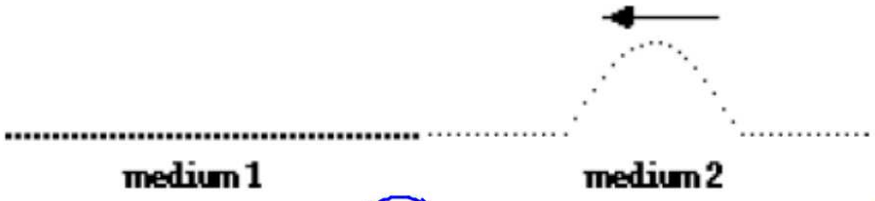
3. The reflected pulse in medium 1 _____ (will, will not) be inverted because the less dense medium acts as a free-end.
4. The speed of the transmitted pulse will be _____ (greater than, less than, the same as) the speed of the incident pulse.
5. The speed of the reflected pulse will be _____ (greater 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.



no reflected wave

larger amplitude
smaller speed

A pulse is moving from a less dense medium to a more dense medium as shown in the diagram below.



7. The reflected pulse in medium 2 _____ (will, will not) be inverted because the more dense medium acts as a fixed end

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

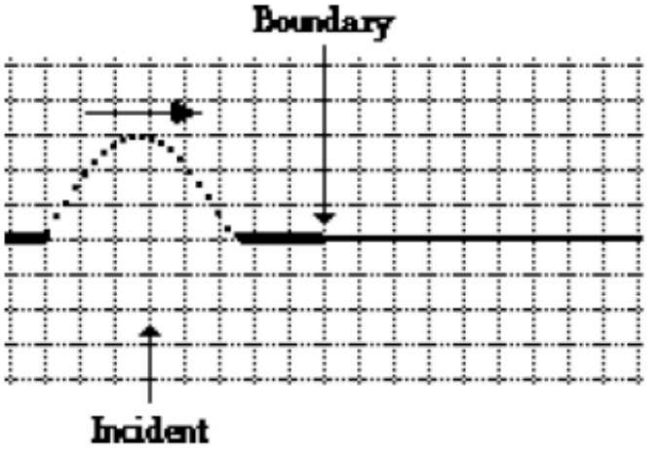
9. The speed of the reflected pulse will be _____ (greater than, less than, the same as) the speed of the incident pulse.

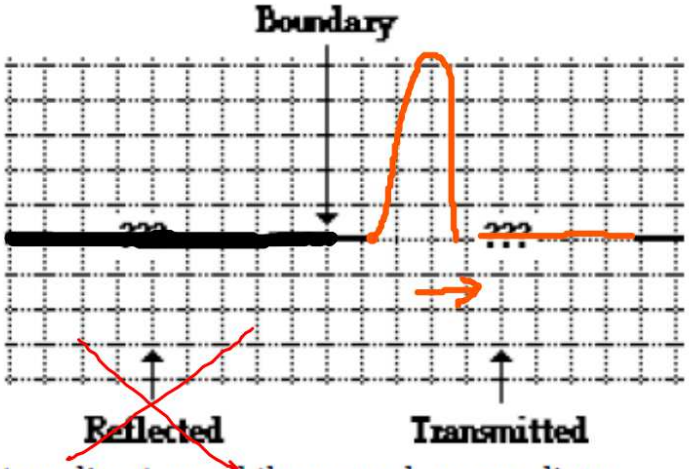
10. The wavelength of the transmitted pulse will be _____ (greater than, less than, the same as) the wavelength of the incident pulse.

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 ...
... speed is _____ (greatest, smallest) in the least dense media.
... wavelength is _____ (greatest, smallest) in the least dense media.
... the reflected pulse becomes inverted only when the incident wave is in the _____ (more, less) dense medium and heading toward the _____ (more, less) dense medium.

12. Incident pulse is in the more dense medium and traveling toward the less dense medium.





13. Incident pulse is in the less dense medium and traveling toward the more dense medium.