Wave Interference

- The speed of a MECHANICAL wave is NOT dependant on frequency or amplitude. The speed is controlled by the medium the wave is travelling through. In air the speed is dependent on the temperature of the air and nothing else or in water the speed is dependent on the depth of the water.

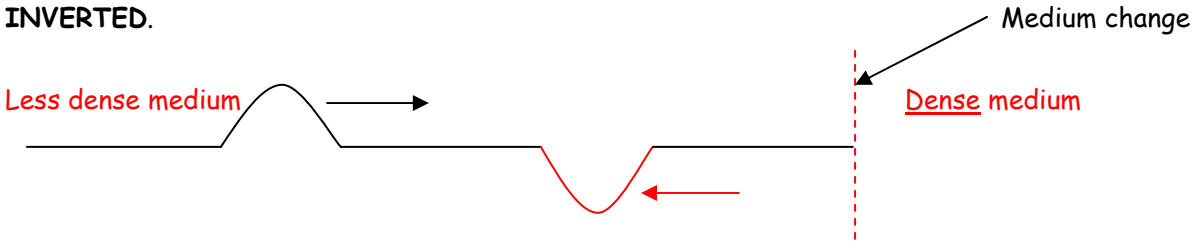
- Often a wave will change from one medium to another. When this transition occurs some of the energy from the wave will continue into the new medium with the same frequency (this is called the transmitted wave) while some of the energy will be reflected back into the initial medium as a wave called the reflected wave.

- What exactly happens when a wave changes medium is one of two things:

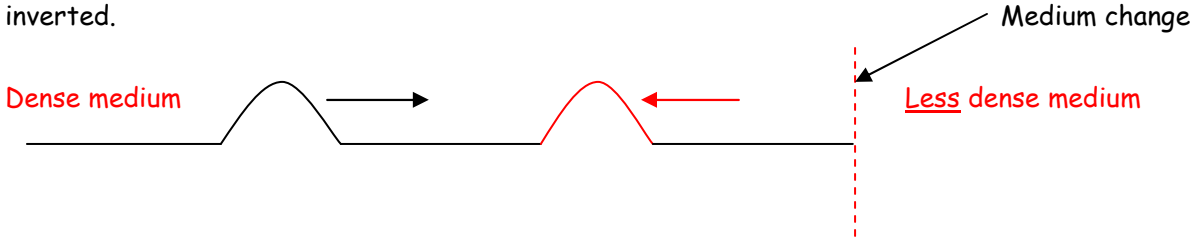
  1.) Medium close to same - most of the energy will be transmitted and the amplitude of the wave will be almost unchanged, while the reflected wave will have very little energy and be small.

  2.) Medium are very different - little energy will be transmitted and the transmitted wave will be small, and the reflected wave will contain most of the energy and be large.

- When waves go from a less dense medium to a denser medium the reflected wave is large and **INVERTED**.



- When waves go from a denser medium to a less dense medium the reflected wave is large and **NOT** inverted.



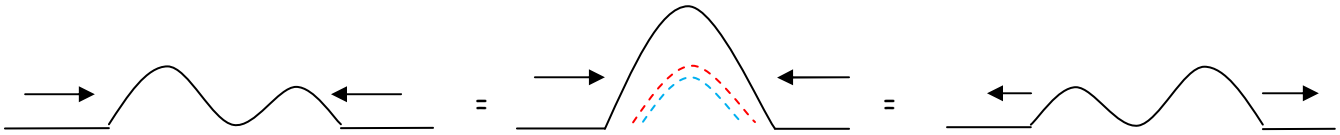
Superposition of Waves

- Many waves can travel through a medium at one time. We can learn about the effects of the different waves using a principle of physics.

- The principle of superposition states that the movement of a medium caused by two or more waves can be calculated by adding the displacement of each wave together. The result of these two or more waves is called interference.

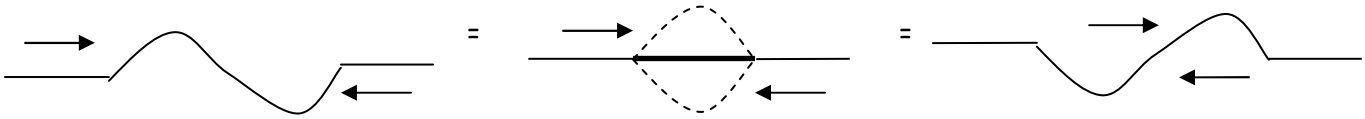
- Interference can take one of two forms:

1.) Constructive interference – when wave displacements are in the same direction. What occurs is the two waves magnify each other (add together) to make one larger wave.



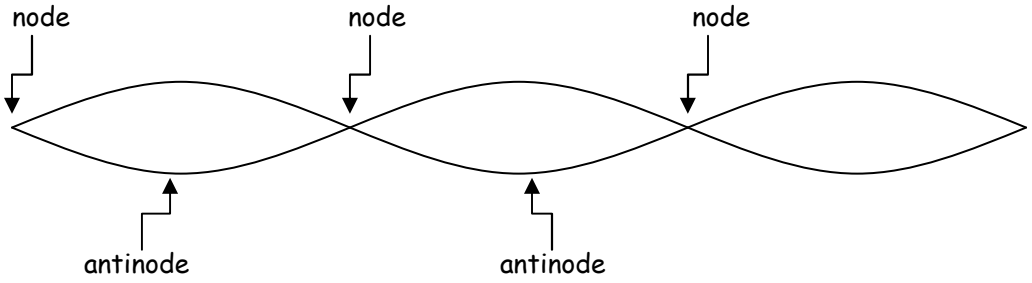
- When two pulses (waves) meet in constructive interference there will be one spot in the medium that is disturbed to a maximum displacement. This point is called an antinode.

2.) Destructive interference – when wave displacements are in opposite directions. What occurs is the two waves cancel their displacements out when they meet to make one smaller wave.



- When two pulses (waves) meet in destructive interference there will be one spot in the medium that is undisturbed. This point is called a node.

- A standing wave is when the pulse of a wave appears to be standing still. This occurs when the period equals the time it takes for the pulse to travel down the rope and the reflection to come back.



- In standing waves the amount of nodes is dependent on how many pulses are being sent down the medium. The minimal number of pulses required to create a standing wave is called the fundamental frequency. The first two nodes create the fundamental frequency and any node after that is considered a MULTIPLE of the fundamental frequency.

These two nodes are creating the fundamental frequency f.

This node is $2f_o$ or a second multiple of the fundamental frequency.