Name(s): _____ Date: _____ Period: _____

Activity #10 Relating Frequency, Wavelength and Speed using a Standing Wave

Problem:

What is the mathematical relationship between frequency and wavelength for a wave traveling in a given medium?

What effect does changing the frequency have on wave speed?

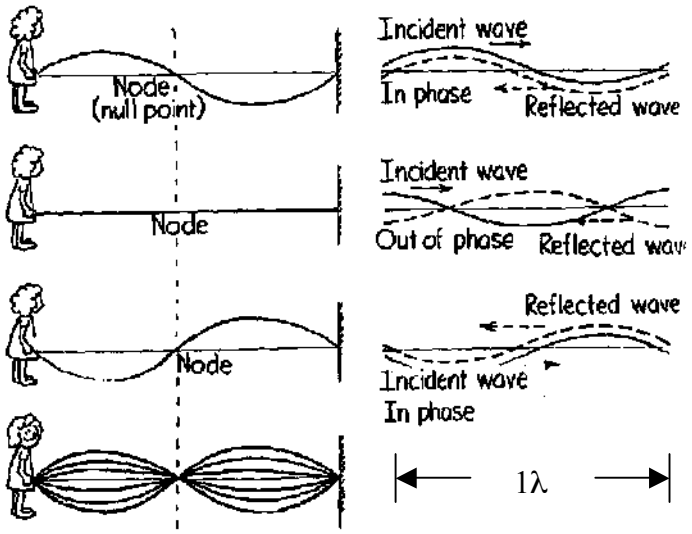
What effect does changing the wavelength have on speed?

Materials:

Meter Stick, Stopwatch, Spring, Slinky™, Cord or Rope.

Procedure:

1. Produce a periodic or standing wave by shaking the spring **horizontally** on the floor's surface (a slinky™ works well) back and forth at a uniform rate.
2. Your partner should act like a solid wall and hold the opposite end very still against the ground while you continue to produce waves. The returning waves will superpose on the waves you continue to produce.
3. Since your partner is holding her end of the spring very still, it, by definition, must be a node. The diagram below shows the waves being generated vertically, but you are to produce yours on the floor, horizontally.



4. Generate wave segments, measuring the wavelength and frequency. One wavelength contains two segments, (node to node to node), as depicted above.[1]
5. To determine the frequency of a wave, time the number of complete oscillations you make during 10 seconds. Frequency is the number of waves, or fraction of waves, you would have made in one second.
6. Complete the data table on the next page.

[1] Diagram from clip art Hewitt Drew It ™, Laserpoint, 1328 W. Palo Alto, Fresno, CA 93711

Data Table

Distance between you and your partner. _____

Wave segments	Wavelength (m)	Frequency (waves/second)	Calculated Speed (m/s)
1			
2			
3			
4			
5			

Summing Up:

1. Make a graph of frequency versus wavelength. What does the graph seem to indicate about the relationship between frequency and wavelength in a given medium?

   _____
   _____
   _____

2. Make a second graph of frequency versus 1/wavelength, 1/wavelength^2, or wavelength^2, as needed, to obtain a straight-line graph. Show on the graph how you determined the value of the slope of the line. Write the equation for the straight line using only physics variables in the equation. _____
   _____
   _____
   _____
   What does the value of the slope, including its units, represent? _____

3. What does the graph indicate about the relationship between wavelength and speed in a **given medium**? (The medium stays the same.)

   _____
   _____

4. What does the equation indicate about the relationship between frequency and speed in a **given medium**? (The medium stays the same.)

   _____
   _____

   If you were to make a graph of speed versus frequency in a **given medium**, what shape would it be? _____
   _____
   If your answer is straight, what would the y intercept represent? _____
   If your answer is not straight, what would you have to change about the X-axis variable to make the graph straight? _____
   _____
   _____