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

ACTIVITY #5 THE EFFECTS OF AMPLITUDE AND MEDIA ON SPEED

Problem:

How does changing the amplitude of a pulse affect the speed of a pulse in a given medium?
How does changing the properties of the medium through which a wave propagates affect the speed of a pulse?

Materials:

meter stick, stopwatch, Slinky™, (A super or "double length Slinky works best, it is about 40 cm long when unstretched) Spiral spring (i.e., Snakey This is about 2.0 cm diameter and about 180 cm long unstretched), cord or rope. (Long Slinky™ or springs that are at least six meters long, if pulled to a comfortable tension, work best.)

Procedure:

1. Use a Slinky™ to determine the time it takes a transverse pulse to travel down the entire length of the medium. Round the time to the nearest 10^{th} of a second.
   Record the time… _____ seconds.

   Change the amplitude of the pulse to three different sizes and determine the time it takes a pulse to travel the same distance as was traveled in step number one. Round the time to the nearest 10^{th} of a second. Record the times in the space below.

Amplitude Size	Time (s)
Small	
Medium	
Large	

   How does changing the amplitude affect the speed of the wave?

   (Optional) View the Cinema Classics–**C** Waves I Title 4 Chapters 4 – 6 determining the speeds of different sized transverse pulses on a torsion bar wave machine.

2. Change a property of the medium by stretching the Slinky™ to a different length or gathering some of the coils into the hand of one of the people holding the spring (or stretching the rope tighter). Determine the time for a pulse to travel the same distance that the pulse traveled in step number one, or actually calculate the speed of the pulse in the new medium and compare it to the speed of the pulse in the original medium.

3. Change the media three more times by altering the tension of the Slinky™. Record the lengths used and the times for a complete pulse to travel through the medium.

Tension Size	Time (s)
Small	
Medium	
Large	

   How does changing the tension of the medium affect the speed of the pulse?

   (Optional) View the Cinema Classics–**C** Waves I Title 3 Chapters 7, 8, 11, and 12 and Cinema Classics – C Waves I Title 4 Chapters 10 – 11 comparing the speeds of transverse pulses in different media.

4. Tie together a spring that has small diameter Snakey and a Slinky™ that has larger diameter coils. Send a pulse from one medium to the other. Sketch what you see.

   What happens as the pulse arrives at the boundary between the two media? To answer the question, you may find it helpful to send a series of pulses down the spring. Focus on the following wave characteristics: amplitude in both media, wavelength in both media, phase of transmitted and reflected pulses, and speed. Hint: speed can be determined by using either the $v = d/t$ calculation or the $v = f\lambda$ calculation.

Direction	Pulse	Wavelength	Amplitude	In Phase or Out of Phase	Relative speed
Snakey to Slinky™ (Slow to fast)	Transmitted pulse				
	Reflected Pulse				

Are the affects the same if the pulse is sent from the other end?

Direction	Pulse	Wavelength	Amplitude	In Phase or Out of Phase	Relative speed
Slinky™ to Snakey (fast to slow)	Transmitted pulse				
	Reflected Pulse				

Try sending a series of pulses down the spring and then varying the frequency with which the pulses are produced. Watch what happens to the wavelength as you decrease and then increase the frequency.

Summing up

1. What characteristics of a wave change as the wave travels from one medium to a different medium?

2. Try to explain why the speed of the wave differs in the two springs. Explain why one might be faster than the other.

3. What seems to be the relationship between frequency and wavelength? Explain how you know.

(Optional) View the Cinema Classics–**C** Waves I Title 34 Chapters 1 – 5 and compare the speed of a transverse pulse as the pulse passes from one torsional bar wave machine to another with different length bars. What changes with respect to the pulse at the boundary between the two media?