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

ACTIVITY #7 REFLECTION AND INTERFERENCE OF PULSES

Problem:

How does a pulse respond when it strikes a barrier?
What happens when two pulses meet?

Materials:

Super or Double Length Slinky™, and string.

Procedure:

1. Attach a long string to the end of a Slinky™. Send a transverse pulse down the Slinky™ while holding the other end of the Slinky™ tightly to the floor. This makes a rigid barrier.

   How do the phases of the original and reflected pulses compare when the reflection is from a rigid barrier?

   _____

   _____

2. Send a transverse pulse down the Slinky™ or coil while holding hold one end of the Slinky™ or coil loosely with a string. You can do this by slipping a (approximately six meters) long, string through 5 or 6 coils of the Slinky™ and doubling the string. Hold the two ends of the string located approximately three meters from the loosely bound Slinky™ to ensure a less rigid medium into which the pulse or wave will travel.

   How do the phases of the original and reflected pulses compare when the reflection is from a non-rigid barrier?

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   _____

   Using ideas about Newton's Third Law, explain why the pulses in question number 1 act differently from those in question number 2.

   _____

   _____

3. From both ends of the Slinky™ send simultaneous pulses (one pinched - longitudinal, one pulled to the side - transverse).

   What happens when the two pulses meet?

   _____

   _____

   Do the pulses appear to pass through each other or do they appear to "bounce back" from the collision with another pulse?

   _____

   _____

   What is the supporting evidence for your response?

   _____

   _____

4. Repeat step #3 using pulses that are both pulled to the side (transverse pulse). Experiment with pulses of the same and different sizes and with pulses in phase and out of phase. Place folded index cards or small drinking cups near the middle of Slinky™ or coil to aid in seeing the interaction.

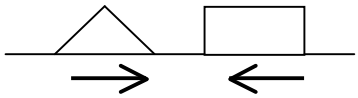
   How does the maximum displacement (amplitude) at the position where the pulses meet compare with the displacement (amplitude) of each individual pulse? Answer the question for the two situations described below.

   If the two pulses are in phase (on the same side of the Slinky™ or coil) when they meet, and the pulses under go Constructive Interference; what happens at the point of intersection?

   _____

   _____

   Draw what happens when the two pulses on the string drawn below meet. Draw what happens after they meet.

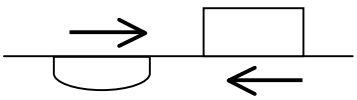
Before	During	After
		

   When the pulses are out of phase (on the opposite sides of the Slinky™ or coil) when they meet, and the pulses under go Destructive Interference; what happens at the point of intersection?

   _____

   _____

   Draw what happens when the two pulses on the string drawn below meet. Draw what happens after they meet.

Before	During	After
		

5. Locate the definition of the Principal of Superposition within your textbook. How do the above activities demonstrate the Principal of Superposition?

   _____

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6. Create a large amplitude pulse on one end of the Slinky™ or coil while another student at the other end of the Slinky™ or coil creates a small amplitude pulse. Send the pulses towards each other down the Slinky™ or coil. Whether or not the pulses are in phase or out of phase, play close attention to where the large and small amplitude waves end up after they meet.

   Comment on an important aspect of wave behavior demonstrated in step number 6.

   _____

   _____

(Optional) View the Cinema Classics–**C** Waves I Title 19 Chapters 1 – 13 and Title 20 Chapters 1 – 5 and examine the superposition of pulses as the pulses undergo constructive and destructive interference. The slow motion and step processes allow for the actual measurement of the waveform of the laboratory activity conducted above.

Questions:

1. Numerically what is the value of the maximum disturbance as compared to the individual disturbances alone?

   _____

   _____

2. A pulse meets a rigid boundary and reflects. Draw the reflected pulse to the right of the diagram below.

3. A toy car meets a rigid boundary and reflects. Draw the reflected car to the right of the diagram below.

4. What fundamental difference do you see in the two diagrams you drew to answer questions 2 and 3? Explain why this difference occurs.

   _____

   _____