Interactive Lab Interaction of Waves
Name_____ Block____

During this interactive you are going to investigate how waves interact when they are in superposition.

1. What is superposition?

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2. What characteristics of two waves moving in opposite directions must be the same so that when they are in superposition they will create a standing wave?

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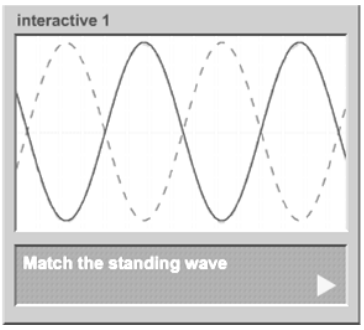

Open the shortcut **IL Int Waves A** on one of the lab stations.
Open the simulation contained in this section. **Do Not follow the directions in the simulation follow the following instructions.**
The dotted lines on the graph show you an outline, or envelope, of a standing wave on a string. Your goal is to match this standing wave by controlling the settings for two waves traveling in opposite directions from the ends of the string.

A1. Determine the amplitude and wavelength of the standing wave by examining the drawing of its outline. You may find it easiest to determine the wavelength by noting points where the wave intersects the x axis. Every grid mark on the graph measures 0.50 m. Record your answers below including units.

Amplitude	Wavelength

A2. From these values, calculate the amplitude to the nearest 0.1 m and the angular wave number to the nearest 0.1 rad/m for the two traveling waves. The angular wave number k and the wavelength λ are related by the equation $k = 2\pi/\lambda$. **Show all work and equations including substitution with units.**

A3. Set the values in the input gauges provided and press GO to see the waves combine and to test your calculations. Did it work? **Y / N** (If it did not recalculate and try again)

A4. Reset the simulation and set the amplitude of one of the waves to twice the value of the other. Do not change the angular wave number. Describe the wave that is produced when these two waves are in superposition.

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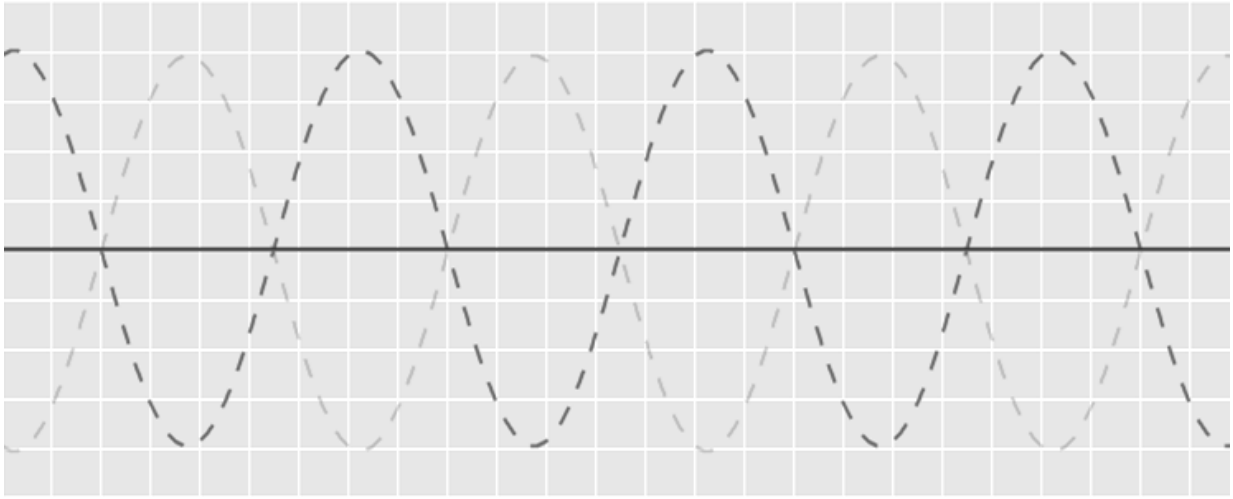
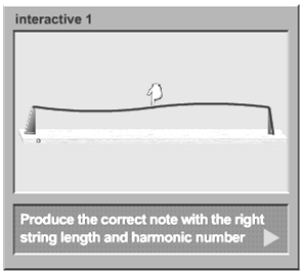
A5. Reset the simulation. You want to create a standing wave that has an amplitude the same as the trace **but** a wavelength twice as long. Calculate the amplitude to the nearest 0.1 m and the angular wave number to the nearest 0.1 rad/m for the two traveling waves. **Show all work and equations including substitution with units.**

A6. Set the values in the input gauges provided and press GO to see the waves combine and to test your calculations. Did it work? **Y / N** (If it did not recalculate and try again) Draw what you see on the simulation.



3. What is the relationship between the length of a string and the wavelength of the fundamental standing wave produced when the string is plucked?



Open the shortcut **IL Int Waves B** on one of the lab stations.
Open the simulation contained in this section. **Do Not follow the directions in the simulation follow the following instructions.**
You are going to ignore the directions in this simulation and after hitting GO for the first time will not need to hit GO again.

B1. Using the simulation complete the chart below including units. You are going to ignore the directions in this simulation and after hitting GO for the first time will not need to hit GO again.

Length	Harmonic	Harmonic	Harmonic	Harmonic
	Frequency	Frequency	Frequency	Frequency
2.00m	1	2	3	4
1.88m	1	2	3	4
1.50m	1	2	3	4
1.20m	1	2	3	4
1.00m	1	2	3	4

B2. From your data from B1 find the speed of the wave in the string. **Show all work and equations including substitution with units.**

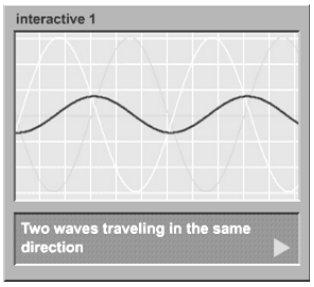
B3. Again, using your data from B1 find a relationship between the frequency (f), the speed of the wave (v), and the length of the string (L).

Prove your answer by calculating frequencies for the given length and then using the simlation to prove your claculated answers correct. **Show all work and equations including substitution with units.**

	1	2	3	4
1.33m	Calculated	Calculated	Calculated	Calculated
	Simulated	Simulated	Simulated	Simulated

4. Explain the concept of a phase difference.

Open the shortcut **IL Int Waves C** on one of the lab stations.
Open the simulation contained in this section. **Do Not follow the directions in the simulation follow the following instructions.**
You are going to ignore the directions in this simulation and after hitting GO for the first time will not need to hit GO again.



The interactive simulation shows two waves traveling in the same direction in the same medium, and the resulting combined wave. The two waves that combine are shown in light orange and pink, and the combined wave is black. The individual waves have the same amplitude, wavelength and speed. However, you can set the phase constant of one wave to create a phase difference between the waves.

C1. Is the combined wave a standing wave? Explain.

C2. Find all the phase constants that will result in a combined wave with maximum amplitude.

C3. Explain the type of interference that is happening during this situation.

C4. Find all the phase constants that will result in a combined wave with minimum amplitude.

C5. Explain the type of interference that is happening during this situation.