

## STANDING WAVES EXPLORATION

*Credits: This lab was derived from one submitted to PhET by N Whipple from West High School on 8/31/11.*

- Go to: <http://phet.colorado.edu/en/simulation/wave-on-a-string>
- Click: Play with Sims → Physics (on the left) → Click on the "Wave on a String" simulation → Run Now!
- Take a few minutes to play with the simulation and familiarize yourself with the controls.

**Reflection:**

1. Set the sim to *pulse* and *fixed end*. Set *damping to 0* and *tension to high*. Send a single pulse and record your observations about the behavior of the pulse below.

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2. Keep all other settings the same and set the sim to *loose end*. Record your observations about the behavior of the pulse below.

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3. Keep all other settings the same and set the sim to *no end*. Record your observation about the behavior of the pulse below.

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**Interference.**

4. Set the sim the same as for step 1. Send a single pulse down the string. When that pulse is about halfway to the other end, send a second pulse. Record your observations about the interaction between the two waves below. (Hint: you can pause the simulation and use the "step" button to view the interaction of the waves more slowly.)

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5. Reset the sim and switch to *loose end*. Send a single pulse down the string. When that pulse is about halfway to the other end, send a second pulse. Record your observations about the interaction between the two waves below.

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6. As a table group (or individually), decide on a question about the interaction of waves that you can test with the simulation. Briefly describe the experiment you devised to test your question.

Group question:

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Experimental procedure:

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Record your observations:

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Based on your experiment and what you saw in steps 4 & 5, what claim(s) can you make about the interactions of waves?

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Provide evidence from your experiment and your observations from steps 4 & 5 to back up your claims.

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### Standing Waves

7. **Reset** the simulation and switch to **fixed end** and **oscillate**. Set the **Amplitude to 10**, **Frequency to 15**, and **Damping to 5**. (wait a few moments for the simulation to adjust to the changes or, switch to pulse, hit reset, and then go back to oscillate.). Record your observations of the wave pattern below.

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8. Change the **Frequency to 25**. (wait a few moments for the simulation to adjust to the changes or, switch to pulse, hit reset, and then go back to oscillate.). Record your observations of the wave pattern below.

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9. Describe any similarities between this pattern and one you produced in step 7.

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10. Adjust the frequency higher to find several other similar (and stable) patterns. Record the frequency of your successful trials. For each successful frequency record the number of points along the wave that appear stationary. Don't forget to count the ends. (Hint: For successful frequencies the left end acts like a stationary point just like the right end even though it is obviously moving. To test to see if it is a stationary point, temporarily [and quickly] set the amplitude and damping to zero. If the pattern remains exactly the same then it was a stationary point.). (Another hint: for very large frequencies, decreasing the amplitude to 5 may help.). Also, draw a small sketch of each successful trial (pause and step for a good view). Organize your data into a table.

FREQUENCY	POINTS	SKETCH

11. Change the sim to *loose end* and try some of the successful frequencies you found in the last step. How are they similar or different? Record the frequencies and the number of stationary points for your trials.

FREQUENCY	POINTS	SIMILARITIES OR DIFFERENCES

**Room for Improvement:**

This lab can be improved by,