**Phet Lab: Waves On A String**

**Intro**: This lab is an inquiry-based exploration to introduce you to the properties of waves. You’ll investigate how changing certain variables affects the wave on a string.

[Instruction Screencast](https://drive.google.com/file/d/1tRjzV4SR80h2beNfrhsEF6ld-WjDUvn4/view?usp=sharing)

Go to **phet.colorado.edu**. Open **HTML5 “Wave on a String”** simulation

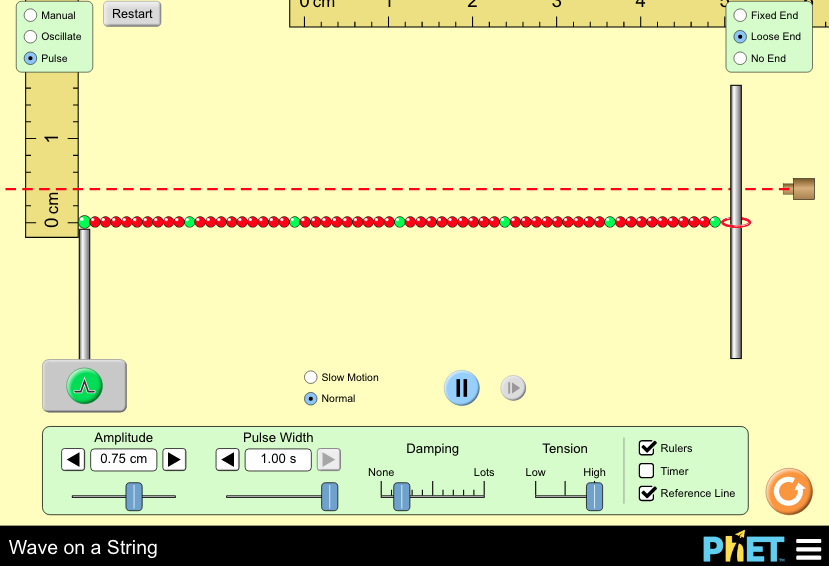
OR

Click [Wave on a String 1.1.22](https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html)

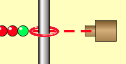
**Part One:**

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| Adjust the simulation settings to:  **Pulse Loose end**  **Ruler Pulse Width:** 1.0  **Damping** to 2nd bar **Tension**: high  \*Click the boxes for **Ruler** and **Reference** in the bottom green box on the right. |

Your screen should look like this:



**Procedure**:

1. Click and drag the vertical ruler to the left side and align the **0 cm** with the **resting point** of the wave (like 0,0 on a graph).
   1. (You don’t need the horizontal ruler yet, so just drag it out of the way).
   2. Use the picture above for guidance.
2. Send a pulse down the string and observe what happens. (click , watch the wave, and observe the ring at the end .)
3. Now click and drag the **Reference line (laser)** to line up at to 2nd mark of the ruler (this is **0.4 cm**).
4. Send another pulse and observe where the END of the wave (the ring) hits compared to the reference mark.
5. Make adjustments to the **amplitude** until the END of the wave (the middle of the ring) hits exactly with the reference mark and write the value below. Make close and careful observations! (  ← middle of ring)
6. Move the Reference Line for the next Measured Height and repeat the process.

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| --- | --- |
| Measured Height at End of Wave  (where you set your Reference Laser) | Amplitude you used (cm) |
| 0.4 cm | 0.65 cm |
| 0.6 cm | 0.95 cm |
| 0.8 cm | 1.25 cm |

Use your **data** to answer this question:

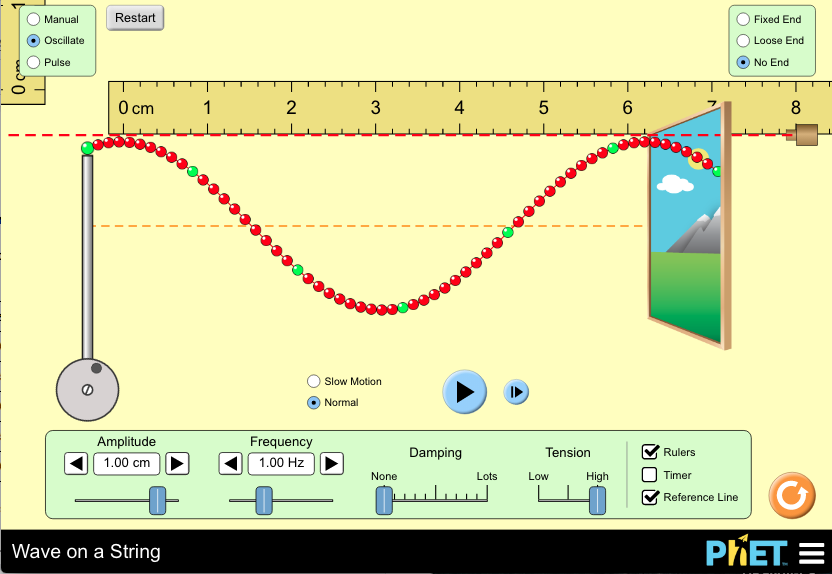
What is the relationship between the **amplitude** of the wave and the **amount of energy** the wave is transmitting? Remember that ***energy is the ability to do “work” (to move something over a distance).***In this case, the energy transmitting through the wave moves the ring at the end a certain distance.

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| The higher the amplitude I used, the \_\_more\_\_ energy the wave transmitted. I know this because: \_\_the string went higher when I used a higher amplitude\_\_. |

**Part 2:**

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| Reset the simulation settings as follows:  **Oscillate No end**  **Rulers Amplitude**: 1.0 cm  **Damping**: none |

Your screen should look like this:



**Procedure**:

1. Start with the frequency at 1.0 Hz. Your wave is probably moving already.
2. Use the **pause**⏯ and **frame advance**⏭ buttons to stop your wave and adjust it so that you have at least 2 good crests (mountain tops).
   1. I like to use the Reference Line (laser pointer) to see if they’re the same height.
3. Use the horizontal ruler  to measure from the top of one peak to the next - this is your **wavelength**.
4. Record it in the table below, then repeat for the next frequency.

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| --- | --- |
| **Frequency** (Hz) | **Wavelength** (cm) |
| 1.0 | 6.2 cm |
| 1.5 | 4.1 cm |
| 2.0 | 3.1 cm |
| 2.5 | 2.5 cm |
| 3.0 | 2.1 cm |

Use your **data** (numbers!) to answer this question:

What is the relationship between the **frequency** of the wave and the **wavelength**?

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| The higher the **frequency** of the wave, the \_\_shorter\_\_ the **wavelength**. I know this because \_\_the wavelength decreased when I increased the frequency\_\_. |

**CONCLUSION**:

**In your own words**, how would you describe these ideas from the lab?

|  |  |
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| **Amplitude**: | The difference between the average point of the wave and the highest point of the wave. |
| **Frequency**: | The number of waves over time. |
| **Wavelength**: | The distance between a top of one peak to the next. |

〜 End of lab 〜