**Waves in a Rope – Simulation**

Aim: to observe relationships between frequency, wavelength, speed of waves in a rope, and observe how these change with changing tension in the rope.

Method: Use the pHet app “Wave on a string”

<https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html>

**Experiment 1 – Speed of wave and tension**

Set to “Pulse”; “Fixed End”; Damping = None; Normal; Tension = Low

Turn the Ruler and Timer on

Use the ruler to measure the length of the piece of string. Record

Click the button on the pulse generator to send a pulse through the rope

Use the timer to measure how long it takes for the pulse to travel back and forth 5 time.

Repeat on moderate and High tension

Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| String length = | | | | |
| Tension | Time for pulse to travel 5 lengths | Time to travel one length | Distance to travel one length | Speed of wave = distance/ time |
| Low |  |  |  |  |
| Medium |  |  |  |  |
| High |  |  |  |  |

Conclusion:

How does tension affect the speed of a wave in a rope?

**Experiment 2: Relationship between wavelength and frequency**

Set to “Oscillate” and “No End”

Keep the ruler and timer on

Set the frequency to 1 and tension to low

Measure the time it takes for a wave to travel the length of the string

Measure the length of a single wave length.

Do the same measurements at Frequency = 2 and 3

Repeat the experiment at moderate and high tension

Results:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tension | Frequency | Time to travel the length of the string | Wavelength | Speed =  Length/time | Frequency X wavelength |
| Low | 1 |  |  |  |  |
| Low | 2 |  |  |  |  |
| Low | 3 |  |  |  |  |
| Moderate | 1 |  |  |  |  |
| Moderate | 2 |  |  |  |  |
| Moderate | 3 |  |  |  |  |
| High | 1 |  |  |  |  |
| High | 2 |  |  |  |  |
| High | 3 |  |  |  |  |

Conclusion:

1. If the tension remains constant and the frequency increases, what happens to the wavelength?
2. Is there any pattern in the last two columns of the table (speed and Frequency X wavelength)?
3. What is the relationship between frequency, wavelength and speed of a wave?