INTRODUCTORY UNIT LAB – WAVE SPEED ON A SLINKY

Introduction

The speed of a wave on a string depends on the tension in the string and its linear density. Linear density is given by the equation:

$$μ= \frac{m}{L}$$

Where *µ* is the linear density of the string, in kg / m;

 *m* is the mass of the string, in kg; and

 *L* is the length of the string, in m.

In this investigation, you will verify this principle using slinkies. You will compare how the speed of a wave on a string compares to the predicted value, given by the equation:

$$v= \sqrt{\frac{F\_{T}}{μ}}$$

Where *FT* is the force of tension in the slinky, in N; and

 *v* is the speed of the wave, in m/s.

The actual speed of the wave is given by the equation:

$$v= \frac{d}{t}$$

Where *d* is the distance the wave travels, in m; and

 *t* is the time taken, in s.

Apparatus:

* Metre stick
* Electronic balance
* Stopwatch
* Slinky
* Newton scale

Procedure:

1. Determine the mass of the slinky and record this.
2. One group member should act as a fixed end, and hold the slinky. Another group member should stretch the slinky to the desired distance. This distance must be measured and recorded.
3. Use a Newton scale to determine the tension in the slinky.
4. Using the free end, send a wave pulse, recording the time it takes the wave to travel to the fixed end.
5. Repeat step # 4 until you have 5 trials.

Errors:

In addition to the usual error analysis, complete the following:

1. Determine the percent difference error between your lowest and highest values for t.
2. Determine the percent mean deviation of your t values.

Discussion:

1. Consider a stringed musical instrument, such as a guitar or violin. What adjustments are made during playing or tuning, and how would these compare with the setup in this investigation?