Chordophone Mini Lab

Choose only 1 side of this sheet to do

**Purpose**: Design an experiment and determine what variables you need to manipulate to find the linear mass density of the string.

**Materials**: Elastic string, sine wave generator, string vibrator, pulley, masses, hanger, ring stands.

**Variables**:

Independent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variable held constant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data**:

Value of constant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| Trial # | Independent Variable Value | Dependent Variable Value | Harmonic Number |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |

**Calculations**:

|  |  |
| --- | --- |
| Trial # | Wave Speed (m/s) |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

Create an equation for the wave speed using your variables above:

Sample calculation for wave speed:

|  |  |
| --- | --- |
| Trial # | Linear mass density,  μ (kg/m) |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

Create an equation for the linear mass density of

the string in terms of the variables above:

Sample calculation for the linear mass density:

What is your average linear mass density? If you are within 5% of value I measured, your group will receive extra credit in participation.

The kit consists of a string, of mass **0.95 g**, a battery holder, an electric motor, a spinning plate and a battery. The mass of everything except the string is **49.28 g**.

1. Plug the battery into the holder and let it hang down.
2. Hold the string all the way as the end.
3. How many nodes do you see?
4. How many antinodes do you see?
5. How many wavelengths are there?
6. Calculate the wavelength of the waves traveling in the string:

Think about the forces acting on the end of the string. Draw a force diagram of the motor object.

From this calculate the tension force on the string:

Derive and equation for the speed of the waves in the string, then use the values for the tension force, the mass of the string and the length of the string to calculate the speed of the wave.

Lastly, with the velocity of the waves and the wavelength, calculate the frequency that the motor is vibrating at. How many rpm’s is this?