VIBRATING STRING

Objective

To study standing waves on a vibrating string and verify the relationship between frequency, tension, wavelength, speed.

Equipment

A PASCO vibrator with power supply, ring stand, clamps, pulley, two strings of different linear mass densities, a set of weights, a weight hanger, balance scale, and a meter stick

Procedure

1. Measure the length and mass of one string and calculate the linear mass density (mass/length), μ. Clamp the vibrator to the ring stand and the pulley to the desk and attach the string to the vibrator through the hole in the metal strip. Tie a knot in the string to prevent it from sliding out. Run the string from the vibrator over the pulley and tie a loop in the free end. Measure the length of the string between the vibrator and the pulley.

2. With only the weight holder to provide tension, turn the vibrator on. Increase the tension on the string by pushing down on the weight holder with your finger. You will find that at a particular tension the string will make a stable vibration with one or two loops. Estimate the force you are applying with your finger and place an equivalent weight on the holder. Carefully adjust the tension to get the maximum amplitude. When you have reached the maximum amplitude either increasing or decreasing the force should decrease the amplitude of the vibration. Record the weight and the total number of loops obtained over the length of the string. **Measure the distance between two successive nodes in the vibration**. The loop nearest the vibrator is not well defined. Do not use it for measurements.

3. Change the tension to give at least **four** different numbers of loops and repeat the measurements.

4. Repeat all measurements for the second string of a different linear mass density.

Graphs and Diagrams

1. Plot the tension in the string versus the square of the wavelength (calculation 1, below) of the vibration.

Questions and Calculations

1. From your measurements, compute the wavelength of each standing wave pattern.

2. Explain why this particular graph is appropriate for this experiment. **From your graph** determine the frequency of vibration of the wave. Compare this with the value of the frequency based on the fact that wall current is AC 60 Hz.

3. By shaking the string, the vibrator produces waves that travel along the string. What is the speed of the waves? Explain how moving waves produce the stationary pattern observed.