

4.4.4: Procedure

1. Connect the channel one output of the mic pre-amp to channel one of the oscilloscope with a BNC to BNC cable. Connect the magnetic pickup to the channel one input of the mic pre-amp with an alligator clip to BNC cable. Turn on the mic pre-amp and set the gain to 3/4ths maximum. Turn on the oscilloscope and select the *Quick Menu* button. For initial settings, set *Bandwidth* to 20 MHz instead of Full, set the *Time Base* to 10 milliseconds per division and the *Amplitude* to 50 millivolts per division.
2. Referring to Figure 1, connect one end of the first wire to the hook on the back of the apparatus. Feed the wire over the groove on top of the adjustable stop piece, over the pulley at the far end, and leaving the other end of the wire dangling free.

Variation of Mass

3. Adjust the movable stop of the apparatus (an Allen wrench may be required) so that the *center* of the stop is 1 meter away from the center of the pulley opposite.
4. Hook on the 1000 gram mass and position the pickup just below the center of the string (i.e., about 0.5 meters from the pulley or stop). There should only be about 5 mm (0.2 inches) between the string and the pickup.
5. Pluck the string and watch the waveform on the oscilloscope. After the initial transient you should see a fairly repeatable wave shape, although it may not appear perfectly sinusoidal. You can “freeze” the image by hitting the *Capture/Single Shot* button. Determine the time for one cycle based on the *Time Base* setting and the number of divisions in one cycle. The *Vertical Measurement Cursors* can make this job a little easier. Compute the frequency of oscillation and record that value in the first column of Table 1. Alternately, if fairly clean waveforms can be produced consistently, the *Frequency Measurement Function* of the oscilloscope may be used. Also, compute the theoretical frequency value and place it in the second column. Place any comments or observations in the third column.
6. Repeat steps 4 and 5 above, first using 1500 grams and then 2000 grams, recording the appropriate values in Table 1.
7. Copy the values in the middle row (1500 grams) of Table 1 to the first row (1 meter) of Table 2.

Variation of Length

8. Apply 1500 grams total to the end of the wire.
9. Reposition the stop so that it is 0.5 meters from the center of the pulley and re-position the pickup so that it remains centered along the length of the wire. Pluck the string, determine and record the frequency as per step 5, recording the result in the second row of Table 2.
10. Reposition the stop so that it is 0.25 meters from the center of the pulley and re-position the pickup so that it remains centered along the length of the wire. Pluck the string, determine and record the frequency as per step 5, recording the result in the third row of Table 2.
11. Copy the values in the middle row (.5 meters) of Table 2 to the first row (gauge one) of Table 3.

Variation of Wire Gauge (mass per unit length)

12. Return the stop to 0.5 meters and replace the wire with another gauge wire (or guitar/bass string as available). Configure it as indicated in step 2 and hook on 1500 grams. Position the pickup mid-wire again.
13. Pluck the string and determine the frequency, recording the result in the second row of Table 3.
14. Repeat steps 12 and 13 using the third wire gauge, recording the results in the third row of Table 3.
15. Using the final setup, move the pick up to various positions along the wire, plucking at each new location. Note how the wave shape changes at each position.

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