Name _____ Date _____

AP Physics Lab Activity #18 (35 pts)

Period _____ Mrs. Nadworny

Partners: Due Date _____

Standing Waves

NO Lab Write-Up Required
must be neatly written in pencil

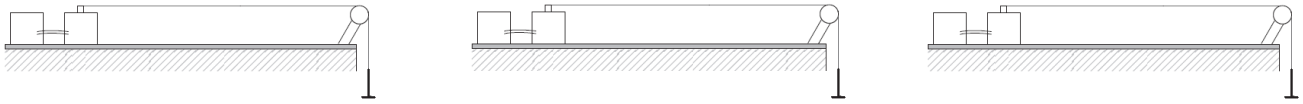
Purpose

To consider the changing variables of standing waves on strings.

PART A

- Independent Variable – *frequency*
- Dependent Variable – *wavelength*
- Control Variable(s) – *string length, mass*

1. On the diagrams, sketch the first three resonant modes of the string, that is, the first three harmonics. (3 pts)

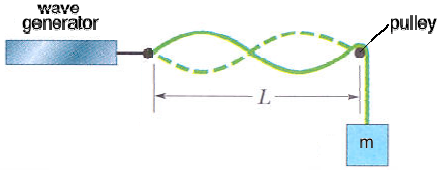


2. If the frequency of the fundamental standing wave is 150 Hz, what are the frequencies of the three waves you drew? (2 pts)

3. If the length of the string is 0.50 meter, what are the wavelengths of these first three harmonics? (2 pts)

PART B

- Independent Variable – *mass (tension & speed)*
- Dependent Variable – *fundamental wavelength*
- Control Variable(s) – *frequency*



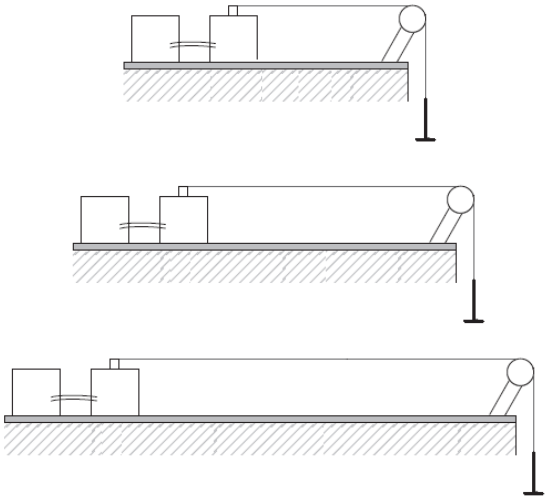
The apparatus shown is used to produce standing waves on a string. The frequency generator forces the electric oscillator to vibrate at a certain rate, which can be varied. The length of the string can be varied. The mass hanging off the end of the string can be varied which will vary the tension in the string (one of the properties of the medium) and hence the speed of the component waves.

Mathematical Model (2 pts)

(Write a math model relating the wavelength of the string to the mass hanging on the string.)

4. As the mass added to the string increases, what happens to the fundamental wavelength of vibration? Explain using a math model. (2 pts)

5. Predict and sketch the first three *fundamental modes* of vibration that occur when the mass is increased. (3 pts)

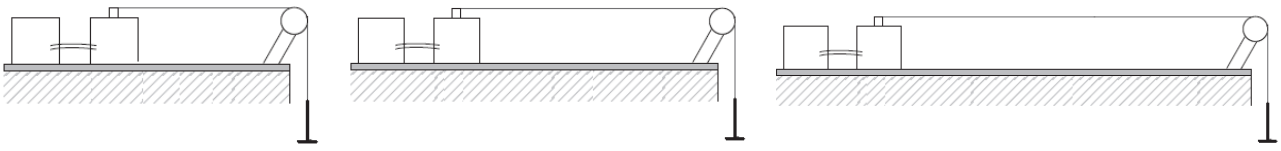


6. Check your prediction by increasing the hanging mass from 200 g, to 500g to 700 g. Record the wavelength for each hanging mass, including appropriate uncertainty. (3 pts)

PART C

- Independent Variable – *length of string*
- Dependent Variable – *number of loops*
- Control Variable(s) – *frequency, mass, fundamental wavelength*

7. Sketch the standing waves for the first three lengths at which the string will resonate. (3 pts)



8. As the length of the string increases, what happens to the wavelength of the standing wave? (2 pts)

9. Calculate the expected value of the speed of the waves if a 500 gram mass is attached to a string with a linear density of .0016 kg/m. Show your calculations below. (2 pts)

10. Predict the three lengths you sketched above using a mass of 500 grams. (The frequency of vibration of the wave generators is set at approximately 60 Hz.) Show your calculations below. (6 pts)

11. Perform the experiment above to check your predictions. Record the lengths of the strings here, with appropriate uncertainty. (3 pts)

(2)
neatness