Student's Name: ________________________________ Student's Name: ________________________________

Lab day & time: ____________________ Date: ___________________

Standing Waves (M10) - Data Sheets

(Show all calculations and write all results on the data sheets in ink)

Activity 1: Standing Sound Waves In a Tube (Closed On One End) *(2 p.)*

Frequency $f = 600$ Hz, $v_{air} = 343$ m/s $L_{eff} = L + 0.01$ m

Theoretical wavelength λ_{theor} = ___________ (m)

Resonance	Measured Air Column Length L (m)	Effective Air Column Length L_{eff} (m)	Measured Wavelength λ (m)	Theoretical Air Column Length L_{theory} (m)	$L_{eff} - L_{theory}$ (m)
$\lambda/4$					
$3\lambda/4$					
$5\lambda/4$					

Frequency $f = 900$ Hz, $v_{air} = 343$ m/s $L_{eff} = L + 0.01$ m

Theoretical wavelength λ_{theor} = ___________ (m)

Resonance	Measured Air Column Length L (m)	Effective Air Column Length L_{eff} (m)	Measured Wavelength λ (m)	Theoretical Air Column Length L_{theory} (m)	$L_{eff} - L_{theory}$ (m)
$\lambda/4$					
$3\lambda/4$					
$5\lambda/4$					

Activity 2: The Fundamental Frequency vs. the Tension of the String *(2 p.)*

The linear density of the string used in this experiment is equal to: $\mu = 1.84*10^{-3}$ kg/m.

Check if the length of the vibrating part of the string L is set to 60 cm, i.e., that the supporting black metal brackets are at positions "10 cm" and "70 cm".

M = 1.00 kg L = 0.600 (m)

	Tension force F(N)	$\sqrt{F}$ $\left(\frac{\sqrt{kg*m}}{s}\right)$	Measured fundamental frequency f_1 (Hz)	Calculated (Eq. 5) fundamental frequency $f_{1\ theory}$ (Hz)
5 Mg	49.0			
4 Mg	39.2			
3 Mg	29.4			
2 Mg	19.6			
1 Mg	9.80			
0 Mg	0	0	0	0

Plot the **measured fundamental frequency** f_1 vs. $\sqrt{F}$. Draw the best-fit line (do **not** just connect the points!). Be sure to include the units. It is recommended that you use a computer-graphing program (e.g., MS Excel that is available in all ITaP labs). Use the 'linear fit' or "trendline" option to obtain the value of the slope of the best-fit line. Print this graph and attach it to this report. Write your name and those of your partners on the graph.

Activity 3: Frequency of a String as a Function of Its Length *(2 p.)*

Adjust the tension in the string to the following value:

$$F = mg = 3\ kg*9.8\ m/s^2 = 3*9.8\ N = 29.4\ N.$$

Measure the frequency using the same method as in *Activity* 2.

Change the length of the vibrating part of the string by moving the two black metal brackets supporting the string. Measure the frequency for the new length.

Length L_x (cm)	Positions of the supporting brackets	Period T (s)	f_x (measured) (Hz)
60.0	10 cm and 70 cm		
50.0	15 cm and 65 cm		
40.0	20 cm and 60 cm		
30 .0	25 cm and 55 cm		

Copy the measured frequency values from the above table. Calculate the theoretical values of the f_x / f_{60} ratio using Equation (7). Calculate the theoretical values of the f_x / f_{60} ratio using Equation (7).

Length L_x (cm)	Period T (s)	f_x (measured) (Hz)	*Measured* f_x / f_{60}	Theoretical f_x / f_{60} based on the length ratio (using Eq. 7)
60.0			1	1
50.0				
40.0				
30.0				

Change the length of the vibrating part of the string back to L = 60 cm by moving the two black metal brackets supporting the string to positions at 10 cm and 70 cm.

Quit *Capstone* application. Do not save any changes.

Complete the lab report and return it to the lab TA.