Studio Lab: Resonance and Standing Waves – Three Tasks

These can be completed in any order and the results are to be added into your course notes to augment Chapter 2 & 3 from your text.

Task #1 – Standing Waves on a String

A string of density 8.5 x 10^{-4} kg/m is attached to a variable frequency generator. On one end you can hang different masses to provide tension to the string. In this task you will determine the wavelength of different standing waves and from this be able to determine the speed of the wave as a function of tension. A pre-lab discussion will help fill in some of the details. Remember that the tension supplied by a mass is equal to the mass multiplied by the acceleration of gravity:

Example: A 200g mass has a weight of (0.200 kg)(9.81 m/s²) = 1.96 N – watch the units!!

To help organize your data please create a table similar to the one shown below and fill in relevant data:

Frequency (Hz)	Number of Loops = Harmonic number	Distance Between Nodes (m)	Wavelength (m)	Tension (N)	Wave Speed (m/s)

Does your data support the equation $v = \sqrt{\frac{T}{\rho}}$

Task #2 – Standing Waves in an Air Column

You will use a tuning fork and a simple resonating tube to measure the distance between nodes of a standing wave for a 1024 Hz sound. Also, note the initial position at which resonance occurs – this should be related to $1/4\lambda$. Make a series of measurements and average your nodal spacing data. ***NOTE: for this part ignore the initial $1/4\lambda$ measured from the end of the tube to the first node***. From this you should be able to calculate a very precise value for the speed of sound in air. Prepare are table similar to this:

Distance from tube end (m)	Node #	Distance Between Nodes (m)	Wavelength (m)	Wave Speed (m/s)

Task #3 – End-correction in an Air Column

You should have noticed something odd about the 1/4λ measured from the front end of the tube to the first node. How does the value for λ that you calculated using the distance from the front end to first node differ from your other wavelength measurements. This is an important piece of information known to instrument builders and is called the end-correction. See if you can determine what this correction is. Does the wavelength appear to be too long or too short and if so, by how much. How does this relate to the diameter of the resonating tube?