**General Physics eJournal 12**

**Resonance in a Tube**

**Instructions:**

Follow the Writeup and fill out the eJournal as you complete the lab activities. Submit your eJournal report by uploading the completed WORD or PDF document to our class Learninghub site. If the Learninghub site is down, email the completed report file directly to a lab TA.

**Preliminaries:**

* Title:
* Name(s):
* Date:
* Time In & Out:

**Plan:**

**Hypothesis**

Sketch how the air vibrates in the first several standing wave modes of an open tube. Formulate a hypothesis regarding the relationship between frequency, fn, and harmonic number, n. Predict the slope of a graph of fn vs n.

*Insert image of your sketches*

**Experiment Outline**

Briefly describe your plan for testing your hypothesis.

**Equipment List**

* List
* Equipment
* Here

**Action:**

Describe the techniques used to collect data by responding to the bullet point questions:

* How did you measure the length of your tube?
* How did you determine the end correction?
* How did you produce sound for the fundamental frequency?
* How did you produce sound for the higher harmonics?
* How did you record/measure the resonant frequencies?

*Insert labeled image of your apparatus*

**Results:**

Measure and record the tube length and tube diameter. Calculate the end correction and the corrected length.

**Table I: Length Measurement and End Correction**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tube Length, L (m)** | **Tube Diameter, D (m)** | **End Correction, ΔL = 0.6D (m)** | **Corrected Length, Lcor = L + ΔL (m)** |
|  |  |  |  |

Measure and record the resonant frequencies, fn, corresponding to their harmonic numbers
(n = 1, 2, 3, …). Insert a screenshot of at least one representative frequency graph.

**Table II: Harmonic Number and Resonant Frequencies**

|  |  |
| --- | --- |
| **Harmonic #, n** | **Frequency, fn (Hz)** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

*Insert Phyphox audio frequency graph*

**Analysis:**

Generate a plot of fn vs n, fit a linear trendline to the data, and record the slope, m, and correlation coefficient, R.

*Insert graph of fn vs n*

Slope = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hz

R = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calculate the measured speed of sound in air (Eq. 6) and compare it to vs = 343 m/s (or vs from the online calculator).

**Table III: Speed of Sound Comparison**

|  |  |  |
| --- | --- | --- |
| **Predicted Speed of Sound, vs (m/s)** | **Measured Speed of Sound, vs meas (m/s)** | **%Diff** |
| 343 |  |  |

Compare the slope to the measured fundamental frequency, f1.

**Table IV: Fundamental Frequency Comparison**

|  |  |  |
| --- | --- | --- |
| **Measured Fundamental, f1 (Hz)** | **Slope (Hz)** | **%Diff** |
|  |  |  |

**Conclusion:**

Interpret your results in light of your hypothetical predictions. Judging by your measurements, what was the relationship between the fundamental frequency, f1, and the higher harmonics? Based on the correlation coefficient, how linear were your results? What does this say about the accuracy of your experiment? How might you improve this experiment or explore it further?