Analysis of Wave Phenomena & Standing Waves in an Air Column

(Speed of Sound)

Name_____ ID_____ TA_____

Partners_____

Date_____ Section_____

Please be careful not to hurt your ears while using tuning forks and speakers. Please treat the glass tube and water bottle gently because they are fragile.

1. **Sound spectra**
   Use the sound sensor and tuning forks to analyze the sound waves; then; answer the questions.

Question 1: What are the differences between "Sound Wave" and "Frequency Spectrum"?

Question 2: Pick up one tuning fork. Does the sound spectrum detect the proper frequency of it? Sketch the graph.

Question 3: Pick up the other one, and look at two graphs. What are the differences between previous and this tuning forks?

Question 4: Detect the background noise with the sensor. Describe the "Sound Wave" and "Frequency Spectrum" qualitatively. Is it different from while using a tuning fork? If so, explain why.

2. Speed of sound in air

➢Speed of sound in air (reference value)

Room temperature $T = \left(\frac{5}{9}\right)\left(^{\circ}F - 32\right)$ _____ $(^{\circ}C)$

Wave velocity in air $v = (331.45 + 0.61 \cdot T)$ _____ (m/s) ← **(1)**

➢Finding the nodes of standing waves

f (Hz)	L (m)	λ = 2L	1/λ

➢Plotting the graph to find the least fits

- From the formula (f=v/λ), if you plot f vs 1/λ, you will obtain the sound speed as the slope. Type the numbers for f and 1/λ on an Excel sheet, and obtain the slope. (If you do not know how to do it, please refer to the manual provided by TA.)

Slope = **Speed of sound in air** = _____(m/s) ← **(2)**

Did you obtain the close results in **(2)** to the reference value **(1)**? _____

Lab Procedure for Analysis of Wave Phenomena and Standing Waves in an Air Column

Please treat the glass tube and bottle carefully because they are fragile.

1. **Sound spectra**

- **Start up Science Work Shop; open the file; go to "library", and "physics"; then, open the file, "P32_SOUN.SWS".**

- **Pick up two different-frequency tuning forks.**
  The frequencies are labeled on the tuning forks.

- **Tap one tuning fork, and look at the graphs, "Sound Wave" and "Frequency Spectrum."**
  Just play with those, and try to answer the questions on the data sheet. If you are not sure about this experiment, feel free to ask TA.

2. **Speed of sound in air**

- **Fill up the bottle with water.**
  When you get trouble with attaching it to the glass tube, please ask TA.

- **Connect the speaker to the amplifier, and the amp. is going to Science Workshop.**
  Make sure how to change the frequencies and amplitudes with "signal generator."

- **Put 2 rubber bands around the glass tube.**
  Those will be the marks for the nodes of standing waves in the air tube.

- **Lift up the bottle to fill the tube with water.**
  You should use two hands to do this because the bottle is slippery.

- **Make a sound from the speaker, and look for the water levels so that you can hear a louder sound; then, mark the level with rubber bands.**
  Only two nodes are enough to have L.

- **Calculate the wavelength, and the reciprocal of the wavelength.**
  Those are for plotting.

- **Repeat the above procedure 7 more times with different frequencies.**
  The minimum and maximum frequencies should be 150 Hz and 1,500 Hz respectively. Other than that, just follow the data sheet.

- **Plot the data, and find the slope by using Excel.**
  Please refer to the instruction provided by TA.

3. **Lab Report**

- **If you got a very different result, please discuss the causes of error.**
- **If you have an application related to your study field, please write it in your report.**