Finding The Speed Of Sound Through Claps

Formal Lab

This experiment was done to find the speed of sound. Although the speed of sound can already be found using the following formula: 331.6 + 0.606(T). The purpose was to find it using claps instead of an equation, similar to how someone without this formula might have found it. The materials for this experiment were a table, meter stick, tape, stereo wired earphones, a computer and Audacity version 3.2.0. The speed of sound from the standard formula was 346.36 m/s at a temperature of 24.2°C. The five speeds of sound gathered from Audacity were 319.6, 358.3, 321.2, 318.0 and 318.0 (in m/s). The average speed of the five speeds was 327.02±20 m/s. Percentage error for this experiment was 5.5%, the percentage difference was 5.7% and the uncertainty was ±20.

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Date of the lab conducted: May 16, 2023
Due date of the lab: June 19, 2023

INTRODUCTION

This report is about how accurate one can get to finding the speed of sound by other means instead of using the standard formula *331.6 + 0.606(T)*. In this lab, one person stood at the end of a table, on top of the table was a meter stick with one end facing towards the person and the other end facing away. Two stereo earphones were connected to a computer recording on the software Audacity and each earbud was taped to the meter stick 0.62 meters apart. Then the person clapped their hands 24 times. Theoretically by checking how long it took from one clap to travel from one earphone to the other the speed of sound could be determined. The experiment was successful, the percentage error was 5.5% and the percentage difference was 5.7%. The speed of sound from *331.6 + 0.606(T)* was 346.26. The speeds of sound gathered from audacity came in the form of 'samples' each samples was multiplied by 10^{-5} and put into v in the formula d/v = t, where distance would be 0.62 meters and t would be the velocity of sound. The 5 speeds of sound gathered from Audacity were 319.6, 358.3, 321.2, 318.0, 318.0 (m/s) . The average of these 5 velocities were 327.02±20 m/s.

HYPOTHESIS

The hypothesis is that the average of the speed of sound from the Audacity data will be similar to what one should get with the standard equation 331.6 + 0.606(T).

APPARATUS AND MATERIALS

- Audacity 3.2.0
- Meter stick
- Wired stereo earphones (skullcandy)
- Computer (HP laptop)
- Table

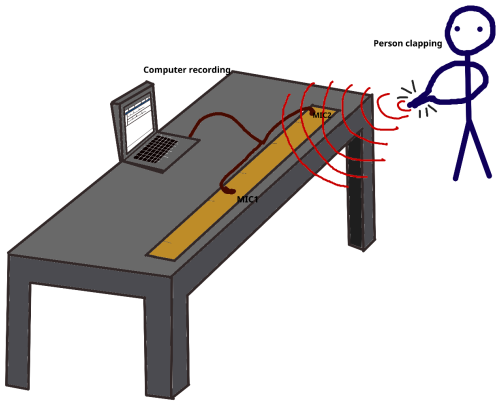
SAFETY PRECAUTIONS

Safety precautions are not applicable as this lab was not dangerous in any way.

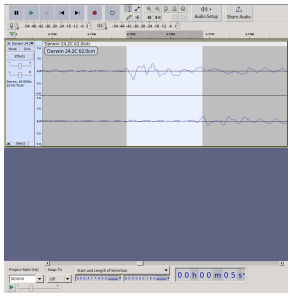
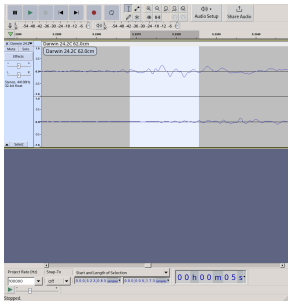
PROCEDURE

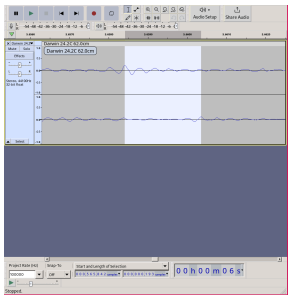
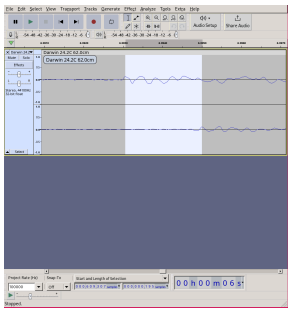
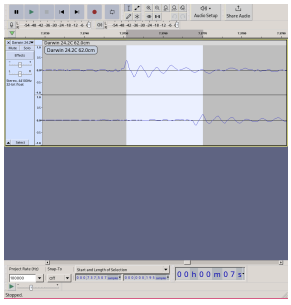
1. The temperature was measured with a thermometer, which was 24.2°C
2. Wired stereo earphones were taped to a meter stick, with each earbud/microphone taped 0.62 meters apart.
3. The Audacity audio software was opened up and started recording.
4. A student on one end of the meter stick clapped their hands
5. Recording was stopped after around 24 claps
6. On audacity the project rate hertz was manually set to 100000 hz.
7. The track was selected and amplified.
8. A crest was selected and zoomed in.
9. The crest of the right audio track was selected and the selection was matched to the crest of the left audio track.
10. Speed of sound = Distance/ (Samples x10^-5) to find the speed of sound
11. 5 speeds were found using the formula above and then the average was calculated.

Illustration of how experiment was done (Image not to scale):



OBSERVATIONS

Try #	Samples	Velocity Of Sound (m/s)	Photo
1	**194**	0.62/0.00194 = 319.6 m/s	
2	**173**	0.62/0.00173 = 358.3 m/s	

3	**193**	0.62/0.00193 = <u>321.2 m/s</u>	
4	**195**	0.62/0.00195 = <u>318.0 m/s</u>	
5	**195**	0.62/0.00195 = <u>318.0 m/s</u>	

(speed of sound from data) Average from data above: <u>327.02</u>±20 m/s

(speed of sound from equation) Vs = 331.6 + 0.606(T) = 331.6 + 0.606(24.2) = <u>346.26 m/s</u>

ANALYSIS AND DISCUSSION

Uncertainty: highest - lowest / 2 = (358.3 - 318.0)/2 = **20.15 m/s**

Percentage Error: $\left(\frac{346.26-327.02}{346.26}\right)\cdot\ 100 = 5.5\%$

Percentage Difference: $\left(\frac{346.26-327.01}{(346.26+327.01)/2}\right)\cdot\ 100 =$ **5.7%**

When comparing the average from the data from Audacity and the value gathered from the speed of sound equation the value did turn out to be pretty similar as hypothesized. The value gathered from the average was **327.02±20 m/s** and the value gathered from the speed of sound equation (331.6 + 0.606(T)) was **346.26 m/s**. The difference between the two is only 19.24 or 5.7%. To get the average from the Audacity data; two crests or troughs were matched up and then the sample number was multiplied by 10^-5, that would be the the velocity, so then to get the time distance which was 0.62 meters was divided by the velocity to get the time (d/v = t). Then the average was calculated with 5 tries. Perhaps to get more accuracy, more tries could have been put into the average or more accuracy could have been implemented into the software, or instead of a human AI could have been put up to the task to do it. The percentage error of this experiment was 5.5% and the uncertainty was 20.15 m/s.

CONCLUSION

The purpose of this experiment was to find out how close one can get to finding the speed of sound with using actual data instead of the formula 331.6 + 0.606(T). The speed of sound was instead found by measuring the time it would take for sound to travel from one microphone to another. The program used for this was Audacity. One student stood on one end of a meter stick and clapped into it. Two earphones/microphones were taped to the meter stick 0.62 meters apart. The audio data was analyzed on Audacity and then the samples gathered by the distance between parallel troughs or crests was multiplied by 10^-5, then it was put into v in the equation d/v = t. After doing the same thing with 5 different claps, the average was gathered and compared with the speed of sound using the normal equation (331.6 + 0.606(T)). The temperature during this experiment was 24.2°C, the distance was 0.62 meters, the percentage error was 5.5%,uncertainty was ±20 m/s and the percent difference was 5.7%.

IDEAS FOR FURTHER EXPERIMENTATION

Other experiments that can be done with this can be trying to find the speed of different kind of waves under different circumstances, perhaps the speed of a water wave at a different temperature, or the speed of a subatomic particle at different mediums. Or the same experiment can be done but with AI gathering data and calculations instead of a human, certain restrictions can be implemented into the AI to try to get similar but varying results.

WORKS CITED

audacityteam. (2022, September 22). Version (3.2.0). *Audacity*. Retrieved June 1, 2023, from https://www.audacityteam.org/.

BLOODHOUND SSC. (n.d.). BLOODHOUND SSC ENGINEERING ADVENTURE .