An Example of a Lab Write Up

Below is an example lab report. Read it and take mental notes on its structure. Is the result convincing? Why or why not? Does the author provide evidence for their claims? After the end of the report we give our analysis of what the author was trying to do and how they tried to achieve it. We hope that the example and our comments will help you write convincing and effective reports.

Measuring the Speed of Sound

Introduction

In this lab, we made a measurement of the speed of sound by measuring the time delay between the sound as it reaches two microphones a known distance apart.

Materials and Method

A pure sound of 2000 Hz was produced in a speaker by a Function Generator, and the signal was picked up by the two microphones. One microphone was attached to a stationary meter stick, and the other to a meter stick that slid along the first one. The microphones were connected into the Oscilloscope so that we could see both signals at once. As the second microphone was moved, its trace on the scope shifted to a later time than the first microphone's trace. We used the markings on the oscilloscope's horizontal axis to determine the time difference between corresponding points on the two signals.

The oscilloscope was set on a Time/Div setting of 0.1 ms per Division, with the Volts/Div setting changed to make the picture visible for each point. For every 0.1 ms of time delay (chosen because that is easy to identify) we measured the distance the second microphone had moved. The table of these results is shown on the left.

Results

t (ms)	d (cm)
0.0	5.7
0.1	9.5
0.2	12.8
0.3	15.7
0.4	20.0
0.5	22.7
0.6	27.3
0.7	30.3
0.8	32.7

Analysis (see graph below)

<u>Calculating the Slope of Best Fit Line:</u>

Points: (0.04, 8) and (0.78, 33)

$\Delta d = 33 - 8 = 25$ cm

$\Delta t = 0.78 - 0.04 = 0.74$ ms

$$
\begin{aligned}
v &= \Delta d / \Delta t \\
&= (33 - 8 \text{ cm}) / (0.78 - 0.04 \text{ ms}) \\
&= (25 \text{ cm}) / (0.74 \text{ ms}) \\
&= 33.8 \text{ cm/ms} \\
&= 338 \text{ m/s}
\end{aligned}
$$

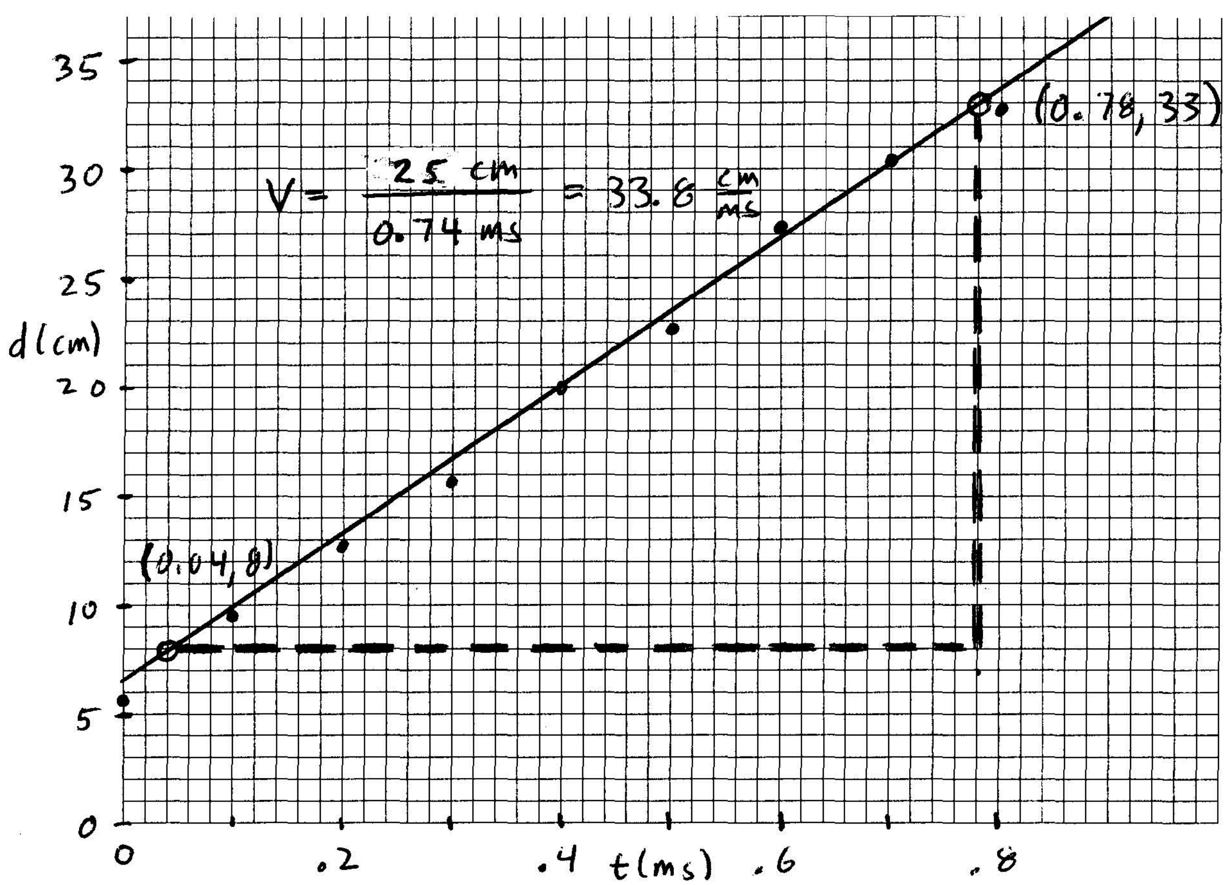
Discussion and Conclusions

The distance measurements were accurate to a millimeter or less. A larger source of uncertainty was the difficulty we had reading the trace on the oscilloscope, since the picture was jiggling and hard to measure accurately. So, time measurements may have been off by as much as 0.02 ms, but with the graphing technique, these errors are averaged out somewhat.

The fit line I got gave an answer of 338 m/s for the speed of sound, which is close to the accepted value. Drawing the "best line" is a matter of judgment. I tried different lines that all seemed like reasonable fits, and found that the slopes varied by about 0.8 cm/ms = 8 m/s, so my determination of the speed of sound is:

$$\mathbf{v = 338 \pm 8\ m/s}$$

Graph of the Data



Lab Write-ups

Your lab write-up is our way of seeing what you learned from doing the lab. It helps you connect that work to the other things we are doing, and to emphasize scientific knowledge is constructed by humans doing scientific investigations ourselves.

Write up your lab work as if it were a communication to lab partners who missed class that day. You need to tell them what you did and why, but you don't have to explain every aspect of the course. You can refer to the lab sheet, but you can't just say, "we followed the lab sheet instructions". The write-up does not have to be verbose, but you need to write in complete sentences and paragraphs. A collection of numbers and scrawls is not enough.

We are not formalists about how you write up your work, but here is a checklist of what things a write-up should contain in some way.

1. ***Introduction:*** *What was the point of the lab?*
Here you explain the purpose of the lab and what you were meant to learn from it.

2. ***Materials and Methods:*** *What did you use and how did you use it?*
Describe the equipment you used and how you used it to make your measurements. If it is not obvious, explain what the equipment does, what you used it to measure, and the method by which you made the measurements. Someone reading this should be able to follow these notes to duplicate your work if they wanted to.

3. ***Results:*** *What results did you get for your measurements?*
You ***have to*** include all of the raw data you took, copied from your lab book. Data are usually best presented in tables, which is also a good way to organize your data as you take them. A list of numbers is not enough; you must give a verbal explanation for your reader to know what these are. ***Label everything clearly.***

4. ***Analysis:*** *What can you figure out from the measurements you made?*
Sometimes you graph your results; sometimes you are comparing them to a theory or an expected value; sometimes you are describing trends in the data or noting information you learned from your measurements. ***Label everything clearly.*** You should also discuss sources of error or uncertainty in the method or experimental design.

5. ***Conclusions & Discussion:*** *What can you conclude from your work and what does it mean in the context of what we have been studying?*
In a paragraph, explain what the results tell you and how your work relates to what the purpose of the lab and other things we have done in the course. You can also explain things that did or not work well, and suggest possible improvements.

Hints for graphing:
Here are general points about graphing. To show you how it should be done, I applied these ideas to the graph for the experiment written up below.

1. Make the graphs as large as possible to give yourself a big picture to analyze.
2. Make the scale using divisions that will be easy to read and to mentally subdivide.
3. If you draw a line to fit the data, eye-judge a line that is close to most of the data points. It may not actually go through any of the data points, just be near them.
4. In finding the slope, use two easy-to-read points ***on the line, not data points***, and spread them as far as possible from each other to give an accurate slope.
