Technical Report Guidelines

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It is essential that individuals be able to express their ideas and defend their arguments with clarity, detail and subtlety. Similarly, it is important that they can read and critique the ideas and arguments of others in like manner. The creation of lab reports assists in this endeavor. All reports should be neat and legible. Standard technical writing style is expected along with proper grammar and spelling. This means that active voice, first person, personal pronouns, and the like should be avoided. For example, don't write “I set the power supply to 6 volts”. Instead use “The power supply was set to 6 volts”. **Reports are an individual endeavor.** Although it is perfectly fine to discuss your data and experimental results with your lab partner, the creation of the report itself is an individual exercise. Plagiarism will not be tolerated. A report should conform to the following outline, in the order given:

1. **General Info.** Title, date, your name, partners name.

2. **Objective (AKA Hypothesis).** Answer the question: “What is/are the item(s) under investigation and their proposed relationship(s)?” These are statements of the items that you are testing in this particular exercise.

3. **Conclusion.** Answer the question “What was shown/verified?” These are concise statements of fact regarding the circuit action(s) under investigation. Make sure that you have moved from the *specific lab situation* to the *general case*. If all works well, these should match nicely with your Objective section. Under no circumstances should you reach a conclusion that is not supported by your data, even if that conclusion is stated in the text or in lecture. What matters here is what **you** did and your analysis of it. If there is a discrepancy between your results and theory, state the discrepancy and **don’t** ignore your results.

4. **Discussion (AKA Analysis).** Reduce and analyze your data. Explain circuit action or concepts under investigation. Relate theoretical results to the lab results. Don’t just state *what* happened, but comment on *why* and its implications. Derive your conclusions from this section. Any deviations from the given procedure (lab manual or handout) must be noted in this section. The Discussion is the penultimate part that you write.

5. **Final Data Sheet.** Include all derived and calculated data. Make sure that you include percent deviations for each theory/measurement pair. Use Percent Deviation = (Measured -Theory)/Theory * 100, and include the sign.

6. **Graphs, Answers to questions at the end of the exercise, Other.** All graphs must be properly titled, created using appropriate scales, and identified with labels. It is suggested that graphs be created with a plotting program or a spreadsheet. Alternately, graphs may be created manually but must be drawn using either a straight edge or a french curve (depending on the type of graph) on appropriate graph paper.

Make sure that you leave sufficient space in the margins and between sections for my comments. Either 1.5 or double line spacing is fine. Multi-page reports must be stapled in the upper left corner. Paper clips, fold-overs, bits of hook-up wire, etc. are not acceptable. Below is the grading standard.

Grade of A: The report meets or exceeds the assignment particulars. The report is neat and professional in appearance, including proper spelling and syntax. The analysis is at the appropriate level and of sufficient detail. Data tables and graphical data are presented in a clear and concise manner. Problem solutions are sufficiently detailed and correct. Diagrams have a professional appearance.

Grade of B: The report is close to the ideal although it suffers from some minor drawbacks which may include some spelling or grammatical errors, analyses which may lack sufficient detail, minor omissions in tabular or graphical data, and the like. In general, the report is solid but could use refinement or tightening.

Grade of C: The report is serviceable and conveys the major ideas although it may be vague in spots. Spelling and grammatical errors may be more numerous than those found in a grade A or B report. Some gaps in data or omissions in explanations may be seen.

Grade of D: Besides typical spelling and grammatical errors, the report suffers from logical errors such as conclusions which are not supported by laboratory data. Analyses tend to be vague and possibly misleading. Graphs and diagrams are drawn in an unclear manner.

Grade of F: The report exhibits many of the following deficiencies: Excessive spelling and grammatical errors, missing sections such as graphs, tables, and analyses, blatantly incorrect analyses, wayward or incomprehensible data, problem solutions tend to be incorrect or missing, and graphical data or diagrams are presented in a shoddy manner.

An Example Technical Report

What follows, starting on the next page, is an example of a technical laboratory report as required for my lab courses including Circuits 1, Circuits 2, Linear Electronics, Operational Amplifiers, Electrical Circuits 1 and Science of Sound. Read the example *after* reading the report guidelines above. This uses the **non-formal** style.

The experiment in question is completely fabricated, but the report will illustrate both the expected form and content. The mock experiment involves measuring the speed of sound in various materials and whether or not this speed is affected by temperature. In this exercise, the experimenter has affixed small transducers to each end of a solid bar of the material under investigation (rather like a small loudspeaker and microphone). A pulse is then applied to one end and a timer is used to determine how long it takes for the wave to reach the other end. Knowing the length of the bar, the velocity may be computed. The bars are then heated to different temperatures and the process repeated to see if the velocity changes. Appropriate tables and graphs are presented.

The report uses 12 point Times Roman font with 1.5 line spacing although 11 or even 10 point may be preferred. There is no reason to "get fancy" with the appearance of the report. In fact, this will only serve as a distraction. Sufficient space is left for the instructor to insert comments. The length of any specific report can vary greatly depending on the amount of data recorded, the depth of analysis, added graphs, and the like.

As is sometimes the case, this mock experiment didn't work perfectly.

Speed of Sound in Various Materials

Science of Stuff, ET301 February 30, 2112

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Partner: Gail Faux

Objective

The hypothesis investigated in this exercise is straight-forward, namely that the speed of propagation of sound depends on the characteristics of the material and that it may be affected by temperature. Three different materials will be investigated, each at three different temperatures. It is expected that the velocity in all three materials will be significantly greater than the velocity of sound in air (343 meters per second).

Conclusion

The speed of sound in a particular material depends on the internal characteristics of the material. The speed may either increase or decrease with temperature. The velocity at room temperature for the SB alloy was approximately 2001 meters per second with a temperature coefficient (TC) of .01%. The GA alloy was 3050 meters per second with -.2% TC, and the CCCD material was measured at 997 meters per second with .1% TC. All values were within a few percent of those predicted by theory, and all velocities were clearly much greater than the velocity of sound in air.

Discussion

To investigate the speed of sound, three bars of material, each one meter long, were obtained. The first was “Sonic Bronze” or SB, an alloy of tin, copper, zinc, and porcupinium. The second material, “Green Aluminum” or GA, is an alloy of aluminum and kryptonite, while the third, CCCD, is commonly known as “Chocolate Chip Cookie Dough”.

An acoustical transducer was attached to each end of the bar under investigation. A pulse was applied to one end and a digital timer was used to determine how long it took for the wave to travel down the bar to the pickup transducer. As each bar was one meter long, the velocity in meters per second is simply 1/time delay. The bar was then placed in an industrial oven and the measurement repeated at temperatures of 75°C and 125°C to compare to the nominal room temperature (25°C) results.

The room temperature results agreed strongly with the published data of the three materials. Comparing Table 1.1 to the 25°C column of Table 1.2 showed a deviation no worse than 1.64% (final column, Table 1.2). The variation between materials is approximately 3:1, indicating how strongly the internal characteristics of the material influence the speed of propagation. The CCCD material, being the most plastic, should have the greatest internal frictional losses, and thus, the slowest velocity of the group. This was the case. The inclusion of porcupinium in the SB alloy was responsible for the modest velocity of this material. The waves have to propagate relatively slowly through the porcupinium compared to the GA alloy which is free of this ingredient. The speed of propagation for all materials was significantly faster than the speed of sound through air. Even the slowest of the group, CCCD, exhibited a velocity nearly three times that of air.

The temperature coefficients also showed tight agreement, and appear to be within just a few percent of the established values. Generally, the velocity increases with temperature, although the GA alloy produced the opposite affect. It is assumed that the inclusion of kryptonite in the alloy may be responsible for this. See Graph 1.1 for details.

There was a practical issue involving the CCCD material. The measurements at 25°C and 75°C were satisfactory, however, when the CCCD bar was removed from the 125°C oven it had changed texture and color to a crispy golden brown and produced a strong, pleasing odor. Consequently, one member of the lab group ate approximately 10 centimeters of the bar before the velocity could be measured. To correct for this, the measured time delay was adjusted by a factor of 1.11 as the bar had been reduced to 90% of its original length.

Data

Material	Velocity (m/s)	Temperature Coefficient (% change per degree C)
SB	2000	.01
GA	3000	-.21
CCCD	1000	.105

Table 1.1

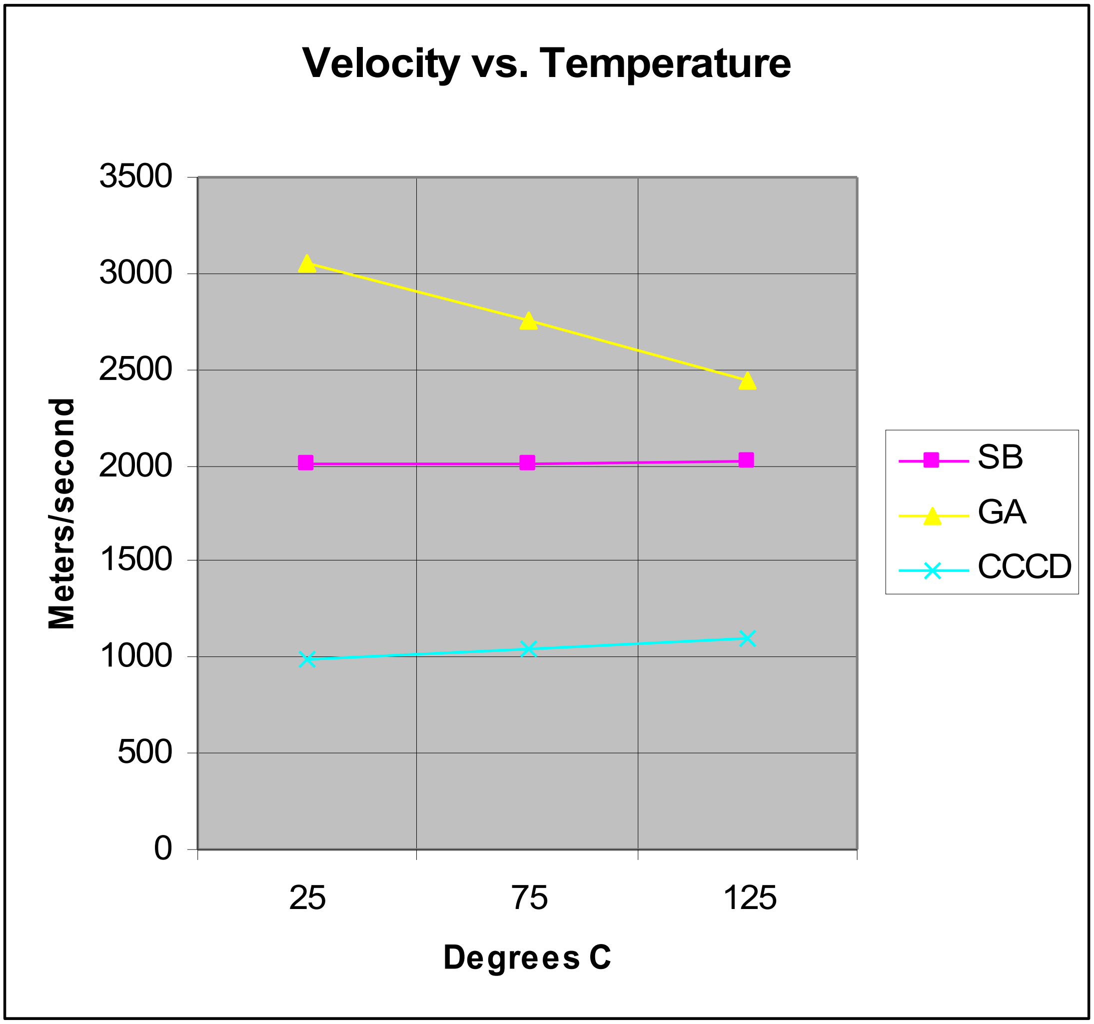
Published Theoretical Velocities and TC

Material	Velocity 25°C (m/s)	Velocity 75°C (m/s)	Velocity 125°C (m/s)	Temperature Coefficient	%Deviation at 25°C
SB	2001	2010	2021	.01	.05
GA	3050	2750	2440	-.2	1.64
CCCD	997	1049	1097*	.1	-.3

Table 1.2

Experimental Velocities and TC

* See Discussion for explanation



Graph 1.1

Variation of Velocity with Temperature, by Material

Answers to Exercise Questions

1. *Is the velocity of sound unaffected by temperature?*

No. Graph 1.1 shows that in some cases (SB and CCCD) the velocity is directly proportional to temperature although it may be inversely proportional (GA).

2. *If the CCCD material had also been subjected to 175°C, what would you expect?*

It is unlikely that a velocity at 175°C could have been measured as the entire bar probably would have been consumed by the lab team before the transducers could be applied.