Writing a Lab Report

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Wilfrid Laurier University

Fall 2015

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It's worth spending time on this.

How is it marked?

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- The lab checklist

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Understanding the checklist will help you do better and waste less time.

How the checklist works

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- Start with 90

  For items *not* in italics

- Subtract 1 for each ˜.
- Subtract 2 for each − .

  For items *in italics*

- Subtract 3 for each ˜.
- Subtract 6 for each − .

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The other 10% is for question answers.

"The other 10 marks will be based on how well the post-lab discussion questions were answered within the text of the report. Remember that the answers to these questions should be an integral part of the report, not merely an afterthought."

A. General

1.	Your own work	_____
2.	Complete	_____
3.	Clear and appropriate "Purpose"	_____
4.	Flows	_____
5.	Did not require help on or after due date	_____
6.	Correct grammar	_____
7.	Correct spelling	_____
8.	Complete sentences where required	_____
9.	Legible	_____
10.	Professionally presented	_____
11.	Properly identified (e.g. name, partner)	_____
12.	On time	_____
13.	Checklist included	_____
14.	Template included	_____

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Checklist section A

B. *Plagiarism Avoidance*

1.	*Data only shared with partner(s)*	_____
2.	*Individual choice of sample data*	_____
3.	*Individual formatting*	_____
4.	*Individual structure of text*	_____

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These two concepts are related, but may get confused. Both involve unethical re-use of one person's work by another person, but they are different because the *victim* is different in each case.

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Following are examples of collaboration that suggest someone is not learning.

Calculations:

Uncertainty in Tension:

$\Delta T = g\Delta m = 9.81 \times .0009 = .0088$

Uncertainty in lambda:

$\Delta\lambda = 2\lambda\Delta T = 2\,(0.71)(.0088) = 0.0125$

Linear mass density for string A:

$\mu = \frac{m_s}{l} = \frac{.00101}{4.51} = .000223947$

$\Delta\mu = \frac{m}{l}\left(\frac{\Delta m}{m} + \frac{\Delta l}{l}\right) = \frac{.00101}{4.51}\left(\frac{.00001}{.00101} + \frac{.005}{4.51}\right) = .000002466$

Square root of tension with uncertainty:

$\sqrt{T} = \sqrt{.27429} = .523727028\ \sqrt{N}$
$= .52 \pm 0.02\ \sqrt{N}$

$\Delta\sqrt{T} = \frac{1}{2\sqrt{T}}\Delta T = \frac{1}{2\sqrt{.27429}} \times .0088 = .008401323$

Uncertainty in linear mass density:

$$\Delta\mu = \frac{1}{slope^2 f^2}\left(\frac{2\Delta slope}{slope} + \frac{2\Delta f}{f}\right)$$

$= \frac{1}{.3291^2 60^2}\left(\frac{2\times.1079}{.3291} + \frac{2\times 0}{60}\right) = .00168$ kg/m

Slope:

$$slope\ max = \frac{(y2 + \Delta y2) - (y1 - \Delta y1)}{(x2 - \Delta x2) - (x1 + \Delta x1)}$$

$= \frac{(0.71+0.0125)-(0.5725-0.0101)}{(0.7776-0.0080)-(0.27429+0.0088)} = 0.3291$

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How likely is it that each partner did the calculations?

Results:

Table 1: Raw Data

Instrument					
Reference (or name)		Meter Stick		Scale	
Units		Centimeters		Grams	
Precision Measure		0.05cm		0.01g	
Zero error					
Number of ½ Wavelengths		Distance From End (d)	Unc. In Distance (Δd)	Hanging Mass (m)	Adjusted Mass ($m + \Delta m$)
Observed N	Used	(Meters)		(Kilograms)	
4	3	0.36m	0.003m	0.02796kg	0.00464kg
5	4	0.28m	0.002m	0.01812kg	0.00082kg
6	5	0.245m	0.002m	0.01241kg	0.00062kg
7	6	0.21m	0.001m	0.089kg	0.0005kg
8	7	0.18m	0.001m	0.0669kg	0.00043kg

Table 2: Data Transformation: Tension and Wavelength

N Observed	Wavelength λ	Unc.Wavelength $\Delta\lambda$	Tension T	Unc.Tension ΔT
	Meters	Meters	Newtons	Newtons
4	0.71	0.0125	0.27429	0.0088
5	0.5725	0.0101	0.1776	0.0080
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How likely is it that each partner created the tables?

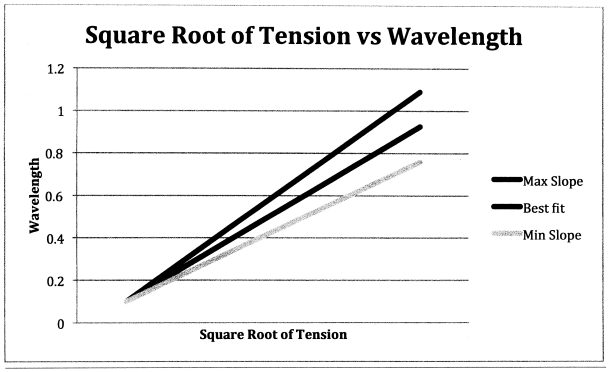
$\Delta slope = mmax - mmin$ = 0.3291-0.2212 = 0.1079

Percent Difference:

$$\left|\frac{calculated\ 1 - calculated\ 2}{calculated\ 1}\right| \times 100\% = \left|\frac{0.71 - 0.57}{0.71}\right| \times 100\%$$

$$= 19.7\%$$

Graph #1: This graph shows the relationship between tension and wavelength



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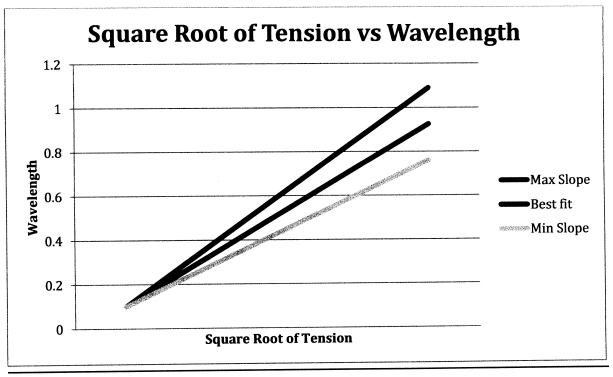

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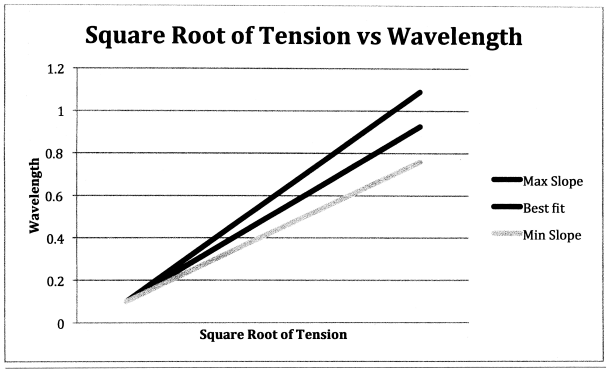

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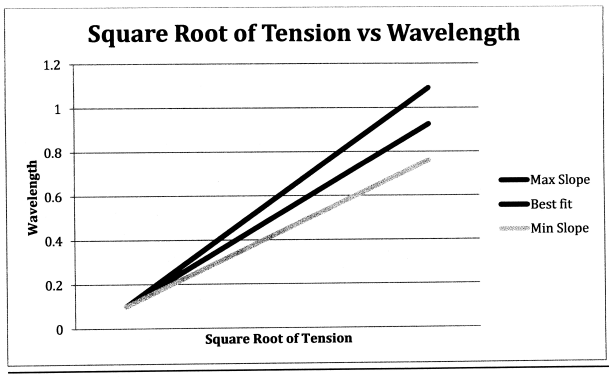

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Along with the paper copy, you will submit an electronic copy which will be tested for plagiarism.

C. Data

1.	Neat	_____
2.	Table column headings informative	_____
3.	Units given	_____
4.	Uncertainties given	_____
5.	Reasonable values	_____
6.	Reasonable uncertainties	_____
7.	Correct number of significant figures	_____
8.	Tables labeled (e.g. "Sample 1 Data")	_____
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Checklist section C

D. Calculations and Results

1.	Any required derivations done correctly	_____
2.	Analysis explained where needed	_____
3.	Correct formulas used	_____
4.	Sample calculations shown where needed	_____
5.	All required values calculated	_____
6.	Uncertainties included	_____
7.	Units included	_____
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Checklist section D

E. *Error Discussion*

1. *Sources listed are significant* _____
2. *Sources are prioritized* _____
3. *Systematic error consequences* _____
4. *Evidence: i.e. test or bound* _____
5. *Reasonable suggestions for improvement* _____

F. *Conclusions*

1. *Relate to purpose* _____
2. *Major results stated* _____
3. *Comparisons made where appropriate* _____
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5. *% difference only when no agreement* _____

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Checklist sections E and F

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   For any *systematic* sources of uncertainty, which way would the uncertainty tend to skew your results?

   Were your results actually skewed in that manner? What does that tell you about that source of uncertainty?

   For any *random* sources of uncertainty, would taking more measurements reduce the uncertainty in your final results? If so, how many measurements would be required for optimal results?

Discussion of Uncertainties

1. What were the most important sources of uncertainty in the experiment?

   For any *systematic* sources of uncertainty, which way would the uncertainty tend to skew your results?

   Were your results actually skewed in that manner? What does that tell you about that source of uncertainty?

   For any *random* sources of uncertainty, would taking more measurements reduce the uncertainty in your final results? If so, how many measurements would be required for optimal results?

2. How could you most easily and effectively improve the experiment if you were to repeat it?

Conclusions

Conclusions

1. What was the purpose of the lab? (May be more than one)

Conclusions

1. What was the purpose of the lab? (May be more than one)
   Was it achieved?

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   Was it achieved?

   Quantitative questions should have *numerical* results (with uncertainties).

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   Qualitative questions should have *non-numerical* statements of results.

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   Was it achieved?

   Quantitative questions should have *numerical* results (with uncertainties).

   Qualitative questions should have *non-numerical* statements of results.
2. All results should be compared with expectations.

Conclusions

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   Was it achieved?

   Quantitative questions should have *numerical* results (with uncertainties).

   Qualitative questions should have *non-numerical* statements of results.

2. All results should be compared with expectations.

   Quantitative results should be shown *numerically* to agree or not with expectations.

Conclusions

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   Was it achieved?

   Quantitative questions should have *numerical* results (with uncertainties).

   Qualitative questions should have *non-numerical* statements of results.

2. All results should be compared with expectations.

   Quantitative results should be shown *numerically* to agree or not with expectations.

   Qualitative results should have *non-numerical* statements of whether or not results were as expected.

Questions which can be answered

Questions which can be answered

- Would a more precise tape measure have helped?

Questions which can be answered

- Would a more precise tape measure have helped?
- Would a more precise stopwatch have helped?

Questions which can be answered

- Would a more precise tape measure have helped?
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Questions which can be answered

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- Would a more precise stopwatch have helped?
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  If so, how many?

All of these can be answered definitively.

What about previous questions?

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- Each week's in-lab questions give insight into the experiment.

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These give lots of possibilities for explaining your results.

Where to answer		
Question number	Discussion (y/n)	Conclusions (y/n)
In-lab		
Post-lab		
Hints		
	"think" "suggest" "explain" "how" "why" "what"	"agree" "equal" "do (did, does) " "significantly different" "support" "verify"

Table 15.6: Lab Report Organization

Table from lab exercises

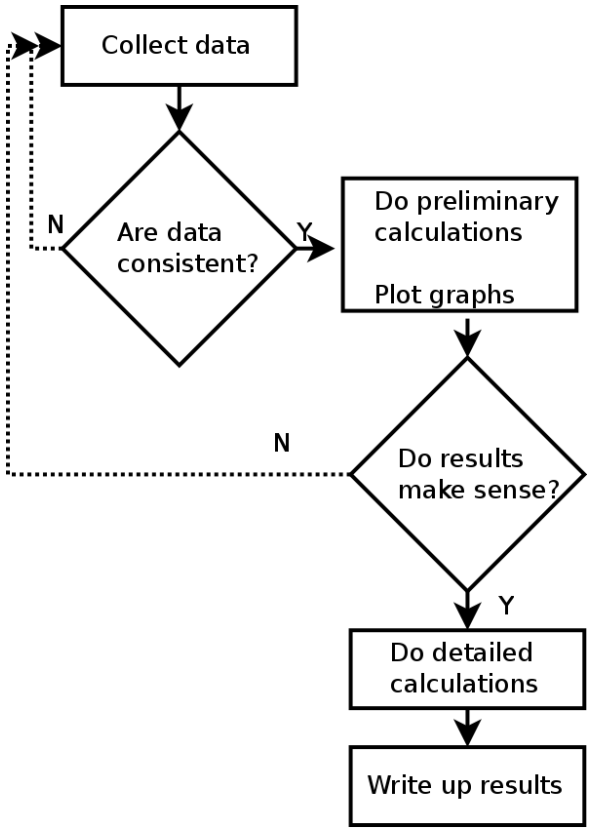
G. References

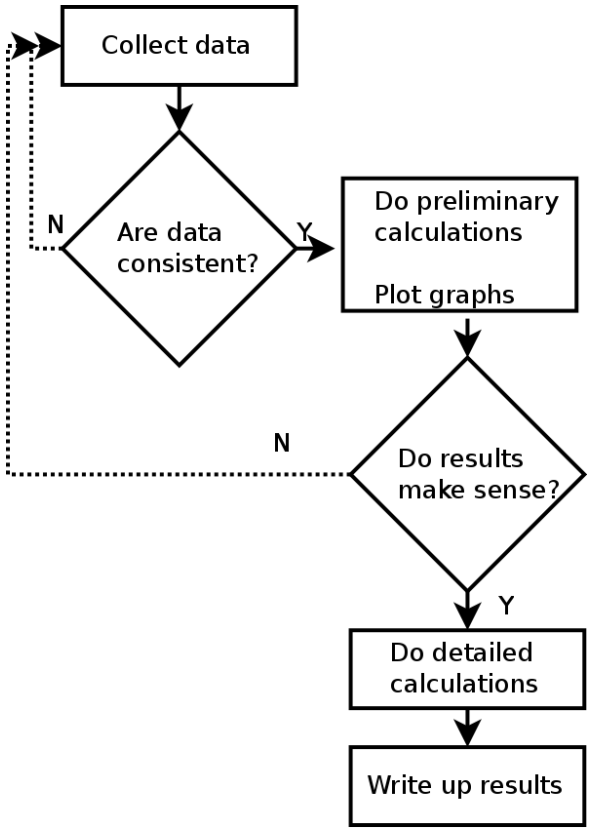
1. Source(s) of constants listed _____

G. References

1. Source(s) of constants listed _____

References


Collect data
Are data consistent?
N
Y
Do preliminary calculations
Plot graphs
Do results make sense?
N
Y
Do detailed calculations
Write up results



Research process