

## Formal Lab Write-ups

You will find in your academic career that every teacher will have a slightly different take on what constitutes a great lab write-up. While there are no universally accepted rules, the following guidelines tend to be the most commonly followed conventions. All formal lab write-ups *must* be done on the computer.

### PURPOSE:

In this section, you must clearly state what is the point of this lab, ex: **The purpose of this lab is:**

- i. **To verify the relationship ...,**
- ii. **To determine if...,**
- iii. **To experimentally determine the relationship between**
- iv. **etc...**

NOTES: Don't forget to use full sentences.

### PROCEDURE:

In this section, you must clearly communicate what happened in the lab. You may reference a lab handout (if you include the handout as an Appendix), but you must note any changes you made to the procedure. Example:

**Procedure:** See Appendix A "Spring Lab". Note that in procedure step 3, four trials were taken instead of three, since the data from the first three trials was highly self-inconsistent.

You must also include an image of your experimental setup. This may be a photograph or a drawing, but in either case it should have a title: (ex "Figure 1: electric circuit setup"). The important components of the setup must be labeled.

### OBSERVATIONS:

In this section, you must record all qualitative observations made during the lab. Ex:

- i. During the course of the experiment, the wires became increasingly warm.
- v. Some vibration was detected in the apparatus

You must also record any raw data in a table. Make sure to include

- a) Uncertainty values
- b) The proper number of significant figures
- c) A descriptive title
- d) Units (m, cm, s etc)
- e) Un-abbreviated measurement names as well as the abbreviation (voltage (V), displacement (d), etc)

Example:

**Very Good**

**Table 1: Voltage and Current Measurements**

Voltage V/V $\pm \Delta V = \pm 0.02 \text{ V}$	Current I/A $\pm \Delta I = \pm 0.2 \text{ A}$
1.03	0.5
3.35	1.2
5.18	2.1
7.20	2.7
8.75	3.5
9.88	3.7
10.32	4.1

**Incomplete**

**Data Table**

Voltage	Current
1	.5
3.4	1.2
5.2	2
7.2	2.7
8.8	3.5
9.9	3.7
10	4

## ANALYSIS:

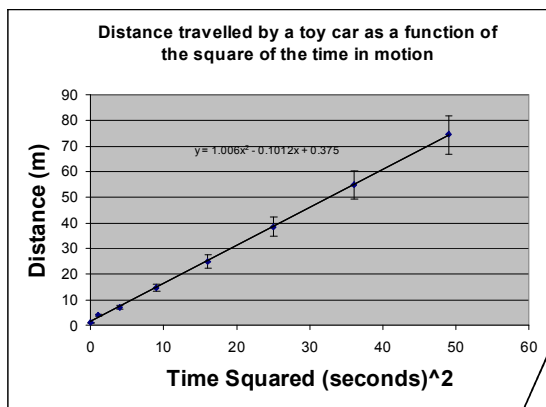
In this section, you must present one sample calculation for each type of calculation you performed. Remember to only round in the last step, and make your calculations neat and clear.

Make sure that you include an error calculation.

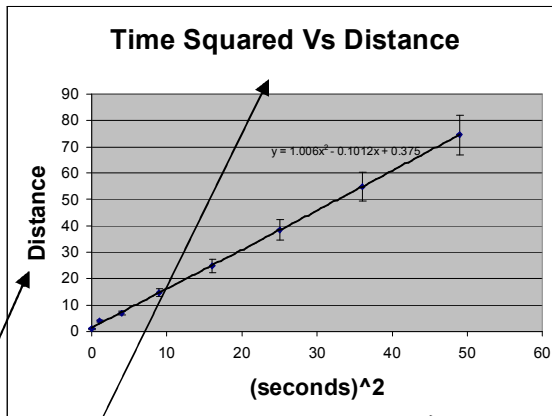
You must also present a graph of your processed data. Make sure you include:

- A descriptive title
- Labels for both Axis (Including Units)

Example: **GOOD**



**INCOMPLETE**



No Units

Title is not detailed enough. Also, titles should always describe dependent variable first

Only units, no title

Make sure to put the graph in this section (ie before the discussion)

## CONCLUSION:

In this section, you must complete the following steps;

- Summarize the important aspects of your results.  
**Ex: The acceleration of the ping-pong ball was found to be directly related to the time spent in the air, with a coefficient of relation of  $1.2 \pm 0.1 \text{ ms}^{-3}$ .**
- State whether this result matched what was expected  
**Ex. This result was 20% higher than the expected value of  $1.0 \text{ ms}^{-3}$  as derived by the Kozak ping-pong postulate.**
- State whether uncertainty in the measured values is enough to account for any deviancy.  
**Ex. Measurement uncertainty cannot account for this degree of deviation, as the uncertainty on the coefficient was 8.3%.**
- Discuss any reasonable source of uncertainty, and state whether that uncertainty was random or systematic. Make sure to state which MEASUREMENT each uncertainty would affect.  
**Ex. One potential source of uncertainty in this investigation was the vibration in the apparatus. As the car moved over uneven ground, the resultant vibrations may have affected the readings of the accelerometer. Since the vibrations were likely to have been in random directions, this uncertainty is likely to have been random, which would have affected the precision of the acceleration measurement.**
- Avoid citing human error as a source of uncertainty.  
**Ex. AVOID saying: It is possible that the volume readings were too low because my lab partner forgot to take the measurement at the right time.**

Note: it IS permissible to cite human limitation.

**Ex. Because of the limited reaction-speed of the observer, the uncertainty on time measurements was taken to be much more than simply half of the smallest increment on the chronometer.**

- f) Use your head. Make sure that the source of uncertainty you discuss can reasonably account for the uncertainty you found.

**Ex. The 50% difference between the measured and theoretical displacements may be accounted for by the imprecision of the ruler used to measure distance. The ruler used was cheaply manufactured and may not have had properly spaced hash marks.**

Unless the ruler was being used to measure very very small distances, this kind of uncertainty is unreasonable as an explanation for a 50% deviance.

- g) Briefly comment on how the investigation could be improved, and what might be a good follow-up experiment.

**Ex. In order to improve the design of the experiment for future trials, it is recommended that photo-gates be used instead of chronometers in order to minimize the uncertainty on time measurements. As well, a C-clamp should be used to attach the trapeze stand to the table, thereby minimizing the uncertainty due to vibrations.**

**A possible extension to this inquiry may be to determine whether the Kozak ping-pong postulate applies to other projectiles besides ping-pong balls.**

### GENERAL NOTES:

- 1) Reports must be written in the 3<sup>rd</sup> person passive voice: Example

**Good**

**“Four measurements were taken.”**

**Bad**

**“We took four measurements.”**

- 2) Be careful with affect vs effect.

**Ex. This may have had an effect. OR**

**This may have affected the measurement.**

- 3) Be careful with “number of” vs. “amount of”.

**Ex. There is a large amount of sand. OR**

**There is a large number of people.**

- 4) Avoid “Hanging Titles” (ie putting the title to a table on the bottom of one page, and then having the table itself on the next page.)

**MARKING RUBRIC**

	<b>Excellent 3 / 3</b>	<b>Good 2 / 3</b>	<b>Poor 1 / 3</b>	<b>Unacceptable 0 / 3</b>
<b>Objective</b>	Clear and concise statement of goal.	Workable statement of goal. Some ambiguity.	Purpose of lab not clearly identified or understood.	"What was this lab about?"
<b>Procedure Equipment Diagram</b>	Clear procedures, with all equipment listed and diagrams of the apparatus set-up	Possible to do the lab if some assumptions are made. One or two omissions in equipment or diagram.	Very difficult to follow, poor description of equipment and set-up	"I think we used that gizmo with all the lights and buttons."
<b>Observations</b>	Clear collection of data in a well presented format. Quantitative information shown in properly formatted tables.	Data given in a format that needs to be tidied up. Some information may be misleading because of the presentation.	Information is difficult to recognize. Does not allow for easy analysis later in lab.	"Was I supposed to write that down?"
<b>Analysis</b>	Perfect analysis based on available observations. Nicely formatted graphs.	Answers objective without completely supporting answer. Some minor calculation errors.	Major calculation errors seriously affect overall analysis.	"That number means the Earth stopped moving for a second."
<b>Sources of Error</b>	Complete list of sources of error, and calculation of error (where appropriate).	List of errors has some weakness and/or calculation of error has mistakes.	Incomplete list of errors and/or no calculation of error.	"is that my sock hanging off that dial? Is that a problem?"
<b>Conclusion</b>	Wraps up the lab like a neat package.	Person still has sight of the purpose of this lab.	Does not show link between objective, hypothesis, and analysis.	"The End."
<b>Final Product</b>		Nicely formatted, double sided report.	Some "Hanging Titles", not double sided.	"My dog got to the printer before I did."

Please include the marking sheet below on your lab. (see my web site <http://www.sd23.bc.ca/~Isloan/>)

Objective	/3
Procedure etc.	/3
Observation	/3
Analysis	/3
Sources of Error	/3
Conclusion	/3
Final Product	/2
<b>Total</b>	<b>/20</b>