Formal Lab Report Guidelines

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General

- At the beginning of your report must be the following: a title; your name followed by your lab partner/members; course and block; and date of submission.
- The lab report is to have the following structure with accompanying headings: Introduction, Experimental Method, Data, Analysis and Discussion, Conclusion.
- The lab report must be word-processed with the possible exception of graphs and diagrams. If graphs and diagrams are completed by hand, they should be scanned and the inserted into the appropriate location in your report.
- While a lab handout may be provided, all sections of the report must be typed yourself and in your own words.
- Everything is to be written in complete sentences.
- Write formally (avoid informal language, contractions).
- Use the same voice and tense as much as possible. Present tense is preferred.
- Proofread and use spell check.
- All values must be expressed with units and the correct number of significant figures.
- While labs are often completed in partners/groups, each individual will be required to write a separate lab report. No part of the lab with the exception of raw data, may be copied. Copied reports will receive a zero and will be handled according to the school's policy on cheating.

Introduction *What are you studying, and why should I care?*

- Clearly state the objective of the lab.

- Present all—and only—the background physics needed to understand your paper. Explain relevant concepts and provide any appropriate definitions. Include any relevant equations. While this section will often be guided by introductory pre-lab questions, it should be written as a formal paragraph and not in a question and answer format.

Experimental Method *How did you perform the measurements?*

- Include a description and diagram of the apparatus. If an apparatus diagram is provided in the lab handout, it may be copied directly in your report. *See notes on diagrams below.*

- Describe your procedure in detail so the experiment can be reproduced and potential errors can be analyzed. While the experimental method will often be similar to the lab handout, it should be written in your own words as a formal paragraph rather than a numbered list.

Data *What happened?*

- Show your data, in appropriate forms (e.g. tables). *See notes on tables below.*

Analysis and Discussion *What does the data mean?*

- Convert the raw data into a form suitable for your objectives (e.g. plotting the data and calculating the slope of the best fit line). *See notes on graphs below.*

- Provide example calculations for all values calculated during the course of the experiment (i.e. one example shown for each type of calculation).

- At all points in your analysis, it should be clear to the reader what you are presenting. All equations, calculations and computed values should not stand alone but be accompanied by appropriate commentary.

- Present the final results. If available, compare your results with theoretical or literature values and determine the percent error.

$$\%\ \text{error} = \left| \frac{\text{experimental value} - \text{theoretical value}}{\text{theoretical value}} \right| \times 100\%$$

- Identify possible sources of error. Write down anything that you believe would have significantly affected your results. Be specific and avoid vague phrases such as “human error.” Do not use trivial arguments such as “old equipment.” Discuss how each of these sources would have affected your results.
  - e.g. *We did not take into account air resistance which had an upwards force on the falling mass. An opposing upwards force would result in a decreased acceleration.*

Conclusion *What was the final result?*

- Summarize what was done in the lab to achieve the objective.

- Restate the results relevant to the purpose of the lab. The numerical value must be stated.

Tables

- Tables are labelled and numbered. The label is placed above the table.
- Following the label must be a descriptive caption which explains the table. The reader should be able to understand the table without referring to the text.
- Every table included in the paper must be referred to at least once from the text.
  - e.g. *The calculated focal length of the lens is similar in all five trials, differing by at most 0.15 cm (Table 1).*
- The rows and/or columns should be labelled with units in brackets. With units included in the label, the individual measurements should not have units included.

Table 1: A properly prepared table. Each column is labelled with units in brackets.

Mass m (kg)	Time t (s)	Acceleration a (m/s^2)
0.5	0.43	16
1.0	0.51	11
1.5	0.68	6.5
2.0	0.77	5.1
2.5	0.85	4.2
3.0	0.99	3.1

Diagrams

- Diagrams should be labelled as figures.The label is placed below the diagram. Numbering for tables and figures are independent of each other.
- Following the label must be a descriptive caption which explains the diagram. The reader should be able to understand the diagram without referring to the text.
- Every diagram included in the paper must be referred to at least once from the text.
- The apparatus is drawn as a block diagram which shows equipment essential to the lab. The diagram need not show measurement equipment not part of the apparatus.

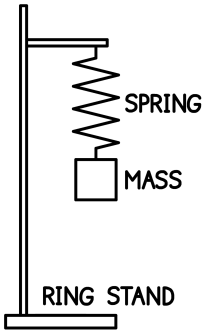

Figure 1: An apparatus diagram. A block diagram is drawn and labelled. Equipment used in the lab but not part of the apparatus are not included in the diagram (e.g. meter stick, stopwatch).

Hand-Drawn Graphs

- Graphs should be labelled as figures (e.g. Figure 2). The label is placed below the graph.
- Following the label must be a descriptive caption which explains the graph. The reader should be able to understand the graph without referring to the text. See the example below.
- Every graph included in the paper must be referred to at least once from the text.
  - e.g. *Current appears to be inversely proportional to resistance as supported by the linear fit of I vs. 1/R (Figure 4).*

- Graphs must be drawn on grid paper.
- Graphs must take up an entire page.

- Graphs must include the following:
  1. Axis Labels: Each label is centred on its axes and written parallel to the axis. The horizontal axis is used for the independent quantity and vertical axis for the dependent quantity. The units are included in brackets.
  2. Scale: A graph needs to have a numerical scale to show the size of the quantities being graphed. When graphing by hand, always choose a scale that allows you to use as much of the graph paper as possible but always choose a scale that is easy to count (e.g. 10, 20, 30, 40).
  3. Data Points: Data points should be easy to read. Do not draw the points too large as this makes it difficult to see the precision of your graph.
  4. Line (or Curve) of Best Fit: Use a ruler to draw a line to represent the trend in the data. The number of points above the line should be balanced with the number of points below the line. **Do not connect the points.**

- Slope calculations must be preformed using two points on the best fit line. **Do not use data points to calculate the slope.** Use large triangle to calculate the slope for more precision.

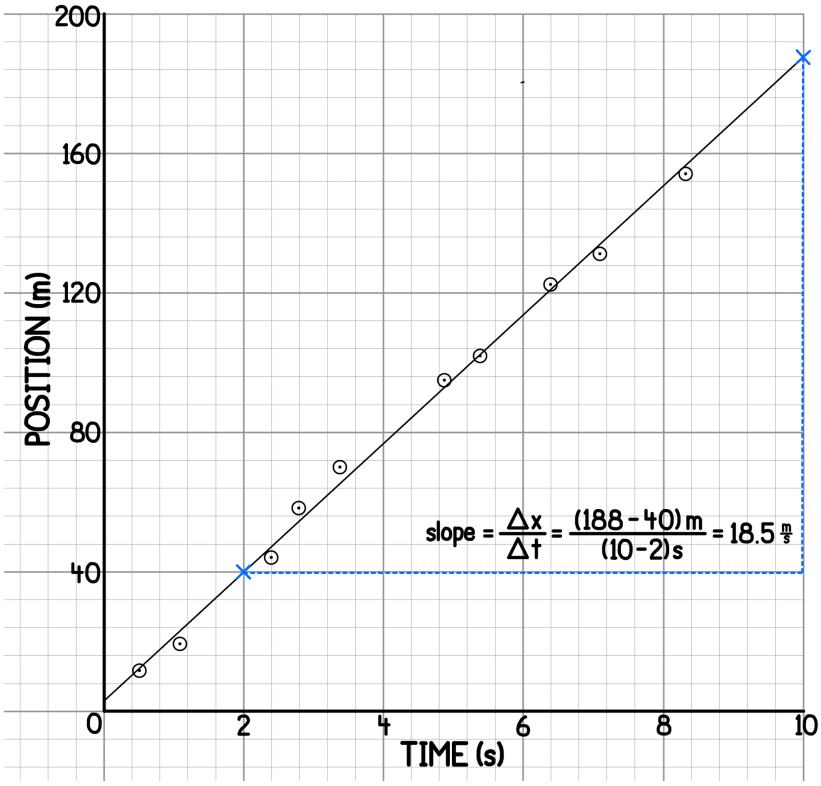

Figure 2: A properly executed hand-drawn graph. The graph includes axis labels, an appropriate scale and a best fit line. The slope of the line is determined using two points on the best fit line (shown in blue), not data points.

Spreadsheet Graphs (e.g. Excel)

- Computer-generated graphs must include all the same information that a hand-drawn graph would include: a figure label with caption, axis labels, an appropriate scale, correctly plotted data points and a best fit line.

- See the Graphing with Excel notes.

- Display the best fit line and its equation directly on the graph.The equation must be stated in your report with appropriate variables (not *x* and *y*).
- The slope can be determined by taking the value from the equation displayed on the graph. **A manual slope calculation is not required.** The slope must be stated in your report with correct units.

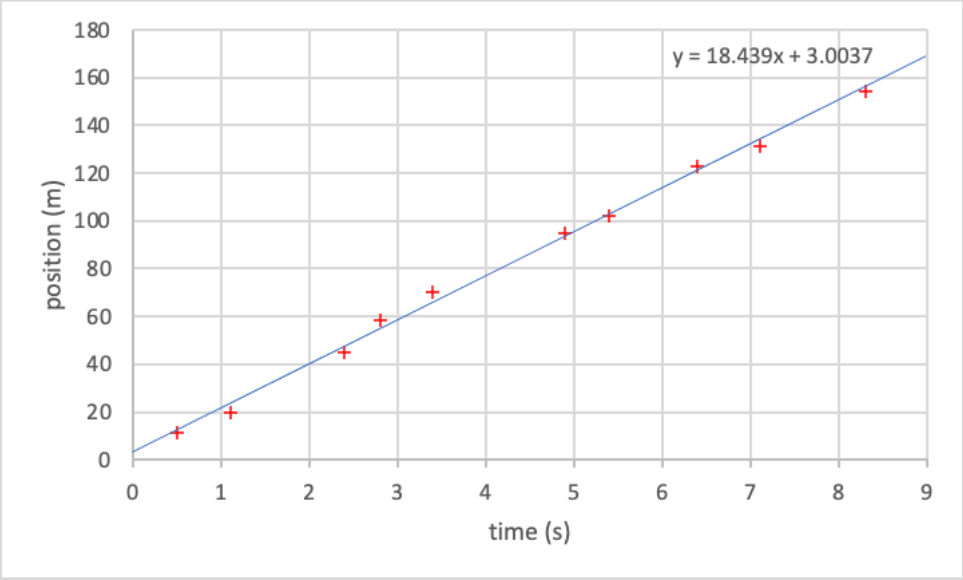

Figure 3: A graph prepared with Microsoft Excel. The graph includes axis labels, an appropriate scale and the best fit line with its equation. The slope of the line can be determined from the equation: 18.4 m/s.