Laboratory Investigations in Physics

Ideally, all investigations of physical phenomena should begin in the laboratory. Data and observations gathered in the laboratory enable the investigator to construct a model (physical and mathematical) that provides a means of predicting the characteristic behavior of the system being studied and to report the findings in coherent and convincing arguments that support the hypothesized model. The development of this argument (the lab report), based on lab data and observations, is a critically important aspect of the laboratory activity. In view of this, the following is offered to assist you in preparing your lab reports.

1. All lab reports are to be written and kept in a bound lab (composition) book clearly marked with your name on the cover. Write on one side of the paper only. Nothing else is to be kept in this lab book.

2. Write your name first, underlined, the names of all members of your laboratory team and the date the investigation was performed in the upper right hand corner of the first page of each report.

3. Each of the following sections of the laboratory report must be included and prefaced with the section names.

4. Lab reports must include graphical, algebraic and verbal representations of the system under study. Other representations, such as diagrammatic, may be used where appropriate.

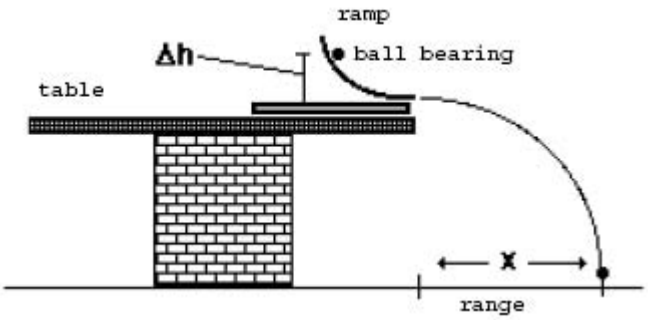
5. Remember, the lab report is how you communicate your findings to others. It needs to be neat, clearly and concisely written using complete sentences and to make sense and be free of errors. It is a complete document and should include all relevant information concerning your experiences in the lab and your findings.

Components of the Lab Report

Title-
When choosing a title for the lab be sure it provides a clue about what you did in the lab.

Purpose-
The statement of purpose provides the overall direction for the laboratory investigation and must be addressed in the conclusion. Care should be taken to formulate an appropriate and concise statement of the purpose. When appropriate, your purpose should include a predicted outcome or hypothesis.

Apparatus-
List all laboratory apparatus used in the investigation. Draw a labeled diagram of your apparatus set-up. You need only show those components which directly influence or are used in measuring your results. Don't waste your time and clutter up your report drawing non-essential details. See example below. The variables to be measured should be clearly pictured.



Procedure-
In this section you should tell me the important components of how you performed the experiment. Identify all experimental variables and briefly describing how the independent variables were controlled. It is not necessary to describe every trivial occurrence but you must include enough detail, including how you processed your data, to gain a clear picture of how the experiment was performed. Someone who was not present during the lab should be able to read your procedure and repeat the experiment just as you did it.

Data-
Data consists only of those values measured directly from the experimental apparatus. No calculated values or interpretations of any kind may be included in this section. Data should consist of as many trials as judgment deems necessary. Data should be organized neatly in tables which have the following features: a title for each table, data arranged in columns and columns labeled with appropriate units.

Evaluation of Data-
This section should include all graphs, analysis of graphs, and post laboratory calculations. State any formulas used, and if necessary, identify the symbols used in the formula. If repetitive calculations are to be performed, show the calculations for the first values and then construct a table of values for all additional calculated values. Be certain that your final calculated values are expressed to the correct number of significant figures. Do not show your arithmetic calculations but DO show algebraic manipulations. Whenever appropriate, data should be graphed. Be sure that your graphs have all of these features: a title, axes labeled with correct units, a uniform scale (every small box is worth the same amount), a line of best fit for linear graphs. If you have more that one line on a graph, be sure to label each line. Write a concise statement for each graph identifying and describing the general form of the best fitting curve or line. Be sure and identify what proportions exists between the variables. If the curve of best fit is not linear then you should construct another graph with the data linearized (show both raw and linearized graphs separately). From your linearized graph, determine the mathematical relationship between the variables (the equation of the line). Include and identify the values and units for the slope and intercept. Show all calculations and formulas used. This section is not the place to talk about the meaning of your graphs, sources of error or other conclusions, "Just the facts".

Conclusion-
This is the section of the lab report that will separate the A's from the B's, who has a grasp of the situation and who is just filling up paper. In this section you will discuss how your lab results relate to your stated purpose. This section must address the stated purpose with a clear concise summary of the experimental findings.

Your conclusions should describe the relationships you found between your experimental variables, i.e.: how does the independent variable affect the dependant variable. This should include a discussion of any proportional relationships found. (If the independent variable is doubled then the dependant variable…) You should use your graphs as support for your conclusions. You should also discuss the meaning and significance of the slope and intercept (including units) of any linear or linearized graphs. Describe and define any new terms that result from your investigation. Use strong, precise language in plain English. Avoid using a lot of pronouns (for example, it) and scientific and mathematic jargon. Ask yourself, "Would a non scientist understand this"?

This is the section to discuss errors and possible sources of error. For example, describe any difficulties that you had with a piece of equipment or sources of error inherent in the equipment. If applicable, compare your results with those of other groups in your class. If your results do not agree with those of others, do not simply say that you made a mistake or that any discrepancies are due to "human error". Bad results due to sloppy lab technique on the part of the experimenters are not acceptable.