IB PHYSICS LABORATORY REPORT GUIDE

Laboratories (practicals) are an important part of IB Sciences. You are formally marked on the following 3 criteria:

Design (**D**) Data Collection and Processing (**DCP**) Conclusion and Evaluation (**CE**)

Depending on the lab, you may be marked on one of these, two of these, or all of these. You will always be told this when given the practical task. This document is meant to be used together with the rubric to help you get a 7 on every lab. Please refer to both often! See '**A Sample 7 Lab Report**' for a full example of what is expected.

All labs, regardless of which criteria is graded, must include a statement of the purpose or question, as well as your hypothesis if appropriate. For non-Design labs, your hypothesis must be briefly and qualitatively justified.

DESIGN (D)

Research Question

- ✓ Clearly stated and *answerable*; the question should refer clearly to the two variables you plan to investigate.

Variables

- ✓ *Independent variable(s)* clearly identified and explained (the variables you control)
- ✓ *Dependent variable(s)* clearly identified and explained (the variables that depend on the independent variable)
- ✓ *Controlled variable(s)* clearly identified and explained (the variables that might affect results but are held constant by you)

Hypothesis

- ✓ A scientific prediction or supposition based on prior observations and which you assume to be the explanation to the problem or research question. It should be stated such that the dependent and independent variables are clearly recognizable. 'If/then' hypotheses make this easier to do.

Background Information

- ✓ An explanation and justification of the hypothesis.
- ✓ Justification of your hypothesis based on what you know from other people's work - literature and textbooks from at least 3 sources. This shows that you have looked at other peoples' work before doing this and have a better idea of what you are doing. Referencing other peoples' work and ideas increases the validity of what you are saying (shows you are not just making it up).
- ✓ Clear *in-text* or *parenthetical* references and with a complete *works cited* list following MLA formatting. The 'works cited' should be on the last page of your report.

Apparatus/Materials

- ✓ Completely listed materials and special apparatus described.
- ✓ Include clearly labeled diagrams *only if needed* (don't use up unnecessary space).

Method (Methodology)

- ✓ Using paragraphs, write a realistic and complete description of your procedure explaining why you did each step and how the variables were controlled. Explain what you did and why. Any procedures coming from another source must be referenced and included in the works cited.
- ✓ Clearly describe how you controlled the variables to make a 'fair' test.
- ✓ Allow for the collection of sufficient data.

Works Cited

- ✓ MLA format including all sources used in the reports. A variety is required, at least three.

DATA COLLECTION AND PROCESSING (DCP)

NOTE: If you are performing a lab to be assessed only on DCP and CE (no Design), you should include a very brief statement of the overall purpose of the lab, and state your hypothesis as in introduction before your first data table. Obviously this only applies if a hypothesis makes sense (for example, you would not make a hypothesis if the goal of the lab is to experimentally find the value of a spring constant).

Data Collection

- ✓ Appropriate raw data collected and recorded including units and uncertainties.
- ✓ Raw data presented clearly (with carefully organized tables or drawings).
- ✓ Data must be *your own,* which YOU have observed, counted and measured BY YOURSELF. Any data from another person or group must be referenced to them.

Data Analysis

- ✓ Raw data processed/analyzed carefully and completely, keeping in mind uncertainties.
- ✓ One full calculation for each calculated quantity needs to be clearly shown, step by step.
- ✓ Remember: errors and uncertainties taken into account at all stages.

Data Presentation

- ✓ Results presented appropriately and effectively. Almost always this will be a graph but may also include some sort of chart, graphical representations table, or annotated drawing.
- ✓ Your presented graphs should clearly show a title, axes labels with units, data points with error bars, and a best-fit line with equation determined by the program algorithm as appropriate.
- ✓ Maximum and minimum lines of best fit are also required for linear analysis, best shown with different colors and with the equation clearly shown on the graph.
- ✓ BE CAREFUL with the scale on your axes. Sometimes a program can zoom in on the data, suggesting a non-linear or random relationship between two variables. It is up to you to decide what scale to use. Generally, the bottom left hand corner of your graph should be the origin (0,0).

CONCLUSION AND EVALUATION (CE)

Conclusion

- ✓ Make a valid conclusion based on correct interpretation and explained.
- ✓ If you have used a program to find the best-fit line on a graph (based on a low RMSE, for example), be careful when making statements like:

  "It is clear from the graph that period (T) and length (L) are related by the function $T = 3.453L^5 - 9.1L^4 + 105.2L^3 + \ldots$*"*

  Remember, programs such as LoggerPro and Excel can fit virtually any type of polynomial to any data; just because it 'fits' does not mean it is ***the*** function. Very often it is not!
- ✓ Unless you are given the particular relation (i.e., linear, quadratic, inverse, etc), you should only make *generalizations* about how the variables *might* be related.

  ("It is clear from the graph that as the length decreases, the period also decreases….")
- ✓ A discussion of the validity and how far the conclusion can be generalized based on the method used. A discussion of the trends seen and how far they would be expected to continue.
- ✓ Restate the research question *("This experiment was trying to determine...")*
- ✓ Restate your hypothesis and decide whether it was supported by your findings.

  ("I expected that if... then..." "This hypothesis was supported because…..")
- ✓ Briefly describe the method.

  ("The change in period of the pendulum swing was determined by maintaining the same mass and varying the string length by… ")
- ✓ Summarize the data collected and note any irregularities.

  ("It was found that as the length of the pendulum string increased, the period..."
  "One the data points was suspect and I decided to throw it out, because….")

Evaluation

- ✓ The method must be evaluated for both validity and reliability. Address the question: Is the method sufficient for producing appropriate data and to what extent does the method produce data showing meaningful trends?
- ✓ Suggestions for modifications of the method based on the evaluation.
- ✓ Describe the limitations of the method in terms of its validity and reliability.

  ("A limitation in the method was that it was hard to control the initial displacement (angle from the vertical) of the pendulum mass for each trial….)
- ✓ Make *realistic* recommendations for how to improve the experiment if you were to repeat it.

  ("This limitation could be addressed by carefully lining up the mass at the beginning of the swing with some fixed object perpendicular to the table top….)
- ✓ Two questions for *realistic* further research (two related experiments). These should be relevant to the lab you just did, and mention what the variables would be (even if the same).

  ("It would be interesting to repeat this experiment with the pendulum mass under water. The variables would again be the length of the string and the period…")

Getting a 7 on an IB Physics lab is easy if you refer to both this guide AND the rubric when preparing your lab.
Refer to 'A Sample 7 Lab Report' for a full example of what is expected.
Good luck!