Physics Lab Report Format

Lab reports for Physics 0861/0871/0983/0993 should be submitted using the following format. All sections must be presented in order. **The instructor may choose to use his/her own format, so consult your instructor for the desired format.**

Remember, the lab report is what *you* think about what *you* did. Lead the reader to the conclusions based on the scientific evidence obtained.

Formal	Informal
Purpose Hypothesis Materials Method Diagram Results Discussion Conclusion Questions	Consult your instructor as to what to include when the lab is "informal"

The following describes each section in detail. All sections must be presented in PARAGRAPH FORM.

Purpose

[1] State the objective(s) of the experiment (e.g., The purpose of the experiment was to ...). The objective is usually stated in the lab manual.
[2] The purpose does not begin with the word, "to".
[3] Background information is not required here.

Hypothesis

[1] State what the results should be and why. In other words, make a prediction and then justify it. If your prediction can not be backed up logically, then you've probably made the wrong prediction.
[2] If the justification is based on some law, you should state the law in your own words and explain what is supposed to happen in the experiment to prove this law.
[3] Do not include any numerical values from the experiment in the hypothesis; however, if a certain value is expected from theory, you should mention it here.
[4] Do not discuss sources of errors in the hypothesis; your hypothesis should be based on what should happen under ideal conditions.

Materials

[1] Write "as given" unless changes were made.

Method

[1] Simply write "as given" ... do not waste your time writing out the procedure.
[2] Note any authorized changes/omissions.

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Diagram

[1] The diagram should not be traced or photocopied from the lab sheet. Include a diagram for every lab report ... some labs may require more than one diagram. Give a short descriptive title to each diagram.

[2] The diagram should illustrate the experimental setup. Label your diagram fully. If you use arrows to label your diagram, make them light.

[3] It is not necessarily to show the electrical cord of equipment that requires electrical power.

Results

Data Tables

[1] (General) Make your own data table(s).

[2] (Framing) They should be framed.

[3] (Titles) An example of a title would be: Table 1. Voltage-Current Data for a Resistor.

[4] (Column Headings) Within each column heading, include the quantity and units. Do not write the units down the columns of your data table.

Example:

Table 1. Distance-Time Data

Time, t (s)	Distance, d (m)	Velocity, v (m/s)
0.1	2.34	23.4

[5] (Correct Significant Figures) Record all data to the correct number of significant figures. In the following example, the data in the second row is incorrectly-recorded.

Table 1. Distance-Time Data

Time, t (s)	Distance, d (m)	Velocity, v (m/s)
0.1	2.34	23.4
0.1	2.5	25

If the distance can be recorded to two decimal places for the first distance, the same should apply for the 2.5 value. Therefore, the second distance should be recorded as 2.50. THIS IS A VERY COMMON ERROR, SO WATCH FOR IT.

[3] (Sample Calculations) (a) Show numerical examples of each different calculation following your data table, not in your data table. (b) Don't describe your calculations in words. The general format for a sample calculation is, as follows:

(Quantity) = (Formula) = (Substitution Step) = (Answer)

Example:

$$d = \frac{v}{t} = \frac{2.34\ m}{0.1\ s} = 23.4\ m/s$$

[4] (Raw Data) Attach raw data to the end of the lab report.

Graphs (if required)

[1] (Graph Paper) (a) Use graph paper ... not hand-drawn graphs. (b) Use metric graph paper, not the type with 1/4" squares. (c) DO NOT USE COMPUTER-GENERATED GRAPHS.

[2] (Scaling Axes) (a) Scale both axes at even intervals. (b) Do not scale your axes using the data values. For example, if your data values are 0.11, 0.35, 0.42 and 0.55, your scale should be 0.1, 0.2, 0.3, 0.4, 0.5 and 0.6. (c) Make adjustments to the scale if all the data points do not fit on the graph. Never tape extra pieces onto your graph page. (d) Don't use scale factors (e.g, x 0.1 s) unless absolutely necessary. (e) A good scale allows you to plot points quickly. A scale like 0, 3, 6, 9, etc ..., would make locating a point like 8.1 difficult.

[3] (Starting Point for Axes) (a) Scales do not have to begin at 0 when the data points are far removes from 0. (b) If the horizontal axis begins at 0, then the vertical axis should go through the zero on the horizontal axis. (c) The axes should begin from the lower left corner.

[4] (Labelling of Axes) (a) Label both axes with quantity and units. (b) The quantity must be spelled out in full. Example: mass (g).

[5] (Sideways Graph) If your graph is plotted on the side, make sure the graph is right side up as seen from a viewer to your right.

[6] (Titling) Title your graph (e.g., Figure 1. Velocity vs Time Graph).

[7] (Data Point Markers) (a) Clearly plot your data points using markers like " " or "+". (b) Do not label each data point with its value. (c) The data point should be no larger than 1 mm in diameter.

[8] (Multiple Graphs on the Same Page) (a) Use a legend or some other method to differentiate between the graphs. (b) Do not use a highlighter pen to do this.

[9] (Linear Graphs) (a) If the data points suggest a linear relationship between the plotted variables, do NOT construct a "join-the-dots" graph ... draw the line of best fit using a ruler. (b) The line of best fit is chosen so that an equal number of data points lie on either side of the line. (c) The line of best fit is NOT the line joining the first data point to the last data point. (d) Do not force the graph through the origin when the data points suggest otherwise. (e) Once drawn, only the points which lie on the line of best fit are used in further calculations (e.g., slope calculation, etc ...).

[10] (Linear Graphs - Slope Calculation) (a) For linear graphs, the slope should be computed on the graph. (b) Choose two points ON the line of best fit. NOTE: THE SLOPE IS NOT FOUND BY CHOOSING TWO POINTS FROM THE TABLE AND THEN PLUGGING THESE NUMBERS INTO THE SLOPE FORMULA. (c) Using a slope triangle, determine the slope using a rise over run method. (d) Do not express the slope as a ratio of two numbers (e.g., use 2.5, rather than 5/2) or as a repeating decimals. (e) Do not forget the units of the slope (the units of the slope is equal to the units of the y-axis quantity divided by the units of the x-axis quantity). (f) NOTE: A straight line yields a CONSTANT slope, not an increasing slope. If the slope represents a quantity, then that quantity is constant. (g) The variable plotted on the vertical axis is directly proportional to the variable plotted on the horizontal axis.

[11] (Curves) If the data points suggest a curve, then draw the best-fit curve through the data points. For this, a flexible drawing curve may be of some assistance.

Further Calculations

[1] If additional numerical calculations is to be performed on the data (e.g., % error calculations, etc ...), put them in this section.

[2] (% Error Calculation) Show how you calculated the % error, indicating what two numbers you are comparing.

(a) (Experiments with a True Value for Comparison) The formula is:

$$\%\ error = \frac{your\ value - true\ value}{true\ value} \times 100$$

The % error will be negative when your value is smaller than the true value. The true value can be a literature value or a value determined by a more reliable method than in your experiment.

(b) (Experiments Where You Just Have Two Values to Compare) The formula is:

$$\%\ difference = \frac{larger\ value - smaller\ value}{smaller\ value} \times 100$$

The % difference will always be positive.

Discussion

(NOTE: The DISCUSSION must be presented in PARAGRAPH FORM.)

[1] This is the most important part of the lab. It connects the purpose and the results and leads the reader to the conclusion drawn.

[2] Discuss/interpret the results for each part of the lab. Everything was done for a reason, so look for trends in the columns of your data table; interpret what the graphs indicate; etc ...

[3] (Discussion of Graphs) For each graph, discuss: (a) what was graphed? (b) what type of graph resulted? (c) what does it show? (d) if the graph is linear, what is proportional to what? (e) if the graph is linear, the slope is constant, and if the slope represents something, it is constant, too.

Example:

> In Part 2, a graph of distance vs time (see Figure 1) produced a straight line. This shows that the distance was proportional to the time. The slope, which represents the velocity, was constant at 34.7 m/s.

[4] Support your statements with numerical figures (e.g., the experimental value, the theoretical value, the % error, etc ...).

Example:

> Compound XYZ was determined experimentally to have a melting point of 34.2 C. The theoretical melting point is 35.6 C. The % error is -3.93%.

(Note: Because your % error was not 0%, do not say that the experiment was a failure ... always make allowance for experimental errors.)

[5] Do not phrase your sentences as questions in your lab report. Do not pose a question and answer it yourself.

[6] Do not describe the method in the discussion.

[7] (a) Remember that you are discussing the results of the experiment ... you are not writing an essay on the lab topic. (b) Do not make historical references in your lab report.

[8] Do not write the lab report in point form. Be sure to write in paragraphs.

[9] Do not show calculations in the discussion. That was done in the RESULTS section; however, you should mention the final values calculated in your discussion.

[11] Do not compare your results with the lab group beside you. You are discussing your results. Do not let outside findings influence your conclusions.

[12] (Possible Errors) (a) Be specific to the experiment when stating sources of error; avoid generic statements like measurement error, crude equipment, old equipment, equipment error, etc ..., which can be stated for every lab. Answer questions like: what caused the measurement error? if there was a reading error, what caused it? what could have affected the accuracy of the data recorded? (b) Make note of difficulties that occurred in the experiment. A good way to do this is to write down the difficulties as they arise during the experiment. (c) Try to explain irregularities in the lab. (d) Human error, calculator errors, round-off errors, calculator malfunctions, etc ... are not acceptable

ads sources of error. (e) State sources of error for EVERY experiment. Experiments which are qualitative are subject to experimental errors, as well.

[13] (Improvements, if applicable) Only suggest improvements if you can think of something that would significantly improve the results/procedure. Do not state the opposite of every source of error as improvements.

Conclusion

[1] Make a brief statement(s) which summarizes the whole experiment. The conclusion should summarize how the results turned out as it relates to the purpose of the experiment.
[2] (a) The conclusion is not that you can do something; rather, it is what was actually found. (b) If a relationship was established, state the relationship. (c) If laws were proven, state how they were proven. (d) Comment on the accuracy of the findings.
[3] No new information is to be presented here.
[4] The conclusion is always shorter than the discussion
[5] Do not present personal comments in this section (e.g., don't say that your life was changed by this experiment, etc ...).

Questions

[1] Give specific answers. Do not give the right answer and the wrong answer, hoping the marker will mark only the right one. Explain your answers.
[2] Read the question carefully.
[3] Show your work for calculation-type questions. Include the appropriate units.
[4] (Phys 083/093) Questions are all over the lab sheet. For those that haven't been answered in the discussion, you may answer them here.
[5] It is not necessary to write out the question. Just phrase the answer so that reader would know what question you're answering.

References

[1] Using bibliography format, list specific references that you used such as your textbook, a library book, a periodical, a web site, etc ...

The following is just miscellaneous information that may help you with your writing:

Miscellaneous

[1] (Writing Style) (a) Write your lab report using PASSIVE VOICE, PAST TENSE. Using passive voice, the emphasis is on what is done to an object rather than who does it. Do not use words like "I", "We", etc ...

General Pattern:

(object acted on)(action performed on object)

Example:

INCORRECT: I tested the first bottle for the presence of hydrogen.
CORRECT: The first bottle was tested for the presence of hydrogen.

This is the preferred formal for any scientific journal. The basis for this is that science is about the discovery, not about who discovered it. (b) Do not use shorthand and abbreviations (e.g., temp, approx, etc ...).

[2] (Presentation) (a) Present all sections in order. Exercise your creativity and individuality by what you say, not by how the sections are arranged. (b) Data tables and graphs should be part of the RESULTS section, not as attachments to the end of the report. (c) Avoid making the reader have to flip back and forth between pages. (d) Do not use a page protector for each page. (e) Your lab report should be readable like a magazine. (f) Do not put your lab report in a portfolio. (g) Do not use a file folder. (h) The purpose and the conclusion should not appear on the same page.

[3] (Background Reading/Research) (a) Read all the background material related to the experiment. This material will help you understand the lab better; it'll help you answer some of the questions. (b) Look in the textbook for more information on the items that you do not understand. Use the INDEX to locate topics. (c) Research topics in the library. (d) Research topics on the internet. (e) Highlight important items in the lab manual.

[4] (Experiment) Follow the lab procedure very carefully. Marks will be deducted for doing an experiment that you made up as you went along.

[5] (Spelling) Watch your spelling. Make an effort to correct your spelling mistakes in future labs.

[6] (Neatness) (a) Write neatly ... don't scribble when you encounter a word you can't spell. (b) Use a wordprocessor, if you can.

[7] (ACADEMIC MISCONDUCT) Copying, manipulation/fabrication of data, plagiarism, content similarities, etc ..., will not be tolerated and will be HEAVILY PENALIZED. There will be no distinction between those who copy and those who let others copy them. The lab is an INDIVIDUAL EFFORT, not a group effort. ALL PARTIES INVOLVED WILL BE PENALIZED, REGARDLESS OF WHO COPIED WHO. Be remembered as a student who may not always gets a 10 but tries, rather than a student who gets a 10 at all costs. Learn to be independent. When you always depend on someone else, you'll be lost when you have to depend on yourself one day. So, ASK MORE OF YOURSELF now and be proud of yourself.

[8] (Unwritten Laws) (a) In order to foster good habits, make sure you hand your lab report in on the due date. Don't let people see you still working on your lab on the due date. (b) Don't lend your lab report to anyone, before handing it in or after you get it back. (c) Don't throw the rough copy away at school ... scavengers have been spotted. (d) Don't fix your data. (e) Cite your references if you used other sources.