

Physics 130 Lab Syllabus

Instructor: Beth Roberts
239 Julian, 765-658-4658, elizabethroberts@depauw.edu
Office Hours: TBD

Welcome to physics lab!

The purpose of physics lab:

- Explore, and verify for yourself, physics theories and concepts that have been presented in lecture.
- Improve your data collection, analysis, and graphing skills.
- Enhance your expertise in writing scientific reports.

For these goals to be achieved, it is important that you arrive ready for the experiment we will be performing. This will be accomplished by completing a *Pre-Lab Exercise* for the experiment before arriving to class, followed by a timed *Quiz* at the beginning of lab. I will then provide an *Introduction* (*i.e.*, summary of the theory, instruction on safe use of equipment). You will be working with at least one partner. It is important that partners share the responsibilities of the experiment (*e.g.*, one person is not permitted to do all the computer aspects of an experiment.) When you finish an experiment I will initial your lab notebook, at your table. All of your equipment and work area must be organized.

Absence

If you have an excused absence from lab, you will have one (1) week to make up the experiment, except in unusual circumstances. An excused absence generally requires documentation (*e.g.*, a note from your coach, doctor, Student Life, etc.).

If you have an unexcused absence you are not permitted to make up the experiment. If you have three (3) unexcused absences you will receive a lab grade of zero (0). Your fourth (4th) unexcused absence will result in a grade of “F” for the course.

Integrity

While I encourage you to work with other students when studying physics and to take advantage of tutoring offered by me and your lecture professor, be advised that work you submit must be your work alone.

Academic integrity is expected at all times by every student.

Dishonesty will result in penalties as stated in *The Student Handbook*.

I support the zero tolerance policy of DePauw University.

Physics 130 Lab Syllabus

Grading ~ You will be assessed weekly on the following:

Participation (100 points/experiment)

Failure to be a fully participating member of your team will result in a large point penalty.

There are no secretaries in this room.

Notebook (100 points/experiment)

Refer to your *Lab Notebook* handout to understand its proper use. For each experiment, the following point deductions will be made when necessary:

- Failure to bring your lab notebook to lab: 10 points
- Failure to use ink in your notebook: 30 points
- Failure to complete *Step 1 – Step 3* as specified in the *Lab Notebook* handout: 20 points
- Failure to get my initials in your lab notebook before leaving lab: 100 points

Pre-Lab (potential Quiz penalty)

Every experiment has a *Pre-Lab* exercise. Complete the *Pre-Lab* in your lab notebook. I will check your notebook for completion of the *Pre-Lab* at the beginning of lab. If it is not complete by the beginning of lab I will deduct 10 points from the corresponding *Quiz* grade.

Quiz (100 points/experiment)

Every experiment will begin with a timed quiz at the beginning of lab. If you are late to class, you might not have time to complete the quiz.

Partial Lab Report (100 points/experiment)

I will select a section(s) from the *Lab Report Format* for each experiment. Details will be provided as we finish each experiment. The typed section is due the following week at the beginning of lab.

Full Lab Report (100 points)

You will write one (1) full science report this semester. Follow the *Lab Report Format* I have provided to you. Using a report format from another class will likely result in a grade of zero.

Final Lab Grade

Your grades for each category will be averaged. Your final grade is calculated based on the following percentages of each category:

- ***Participation*** - 10%
- ***Notebook*** - 15%
- ***Quiz*** – 30% (An incomplete *Pre-Lab* will result in a 10 pt. penalty on quiz grade)
- ***Partial Report*** – 30% (a specified report section written for each experiment)
- ***Full Report*** – 15% (100 points)

PHYSICS 120 and PHYSICS 130 – PRINCIPLES OF PHYSICS

THE LABORATORY NOTEBOOK

You do not have to be a historian to see the value of the well-organized journal. It serves a valuable role, namely to revive the events of the past. So, what constitutes a good journal for scientists? Anyone who conducts research (either experimental or computational) keeps the journal not just to record the data but also to record the progress and importance of the work.

Since your journal is expected to be a permanent record of your lab experience, we want you to use ink, not pencil, when writing your journal. (That way, nothing important will ever get accidentally erased.) Regarding content, your journal entries for each experiment should contain at least the information listed below.

*To be written in your lab notebook **BEFORE** coming to lab:*

- 1. The Title** of the experiment you will be performing
- 2. The Objective** - Why will you conduct the experiment? What will you try to measure?
- 3. An Outline of the Procedure** - Do not copy verbatim the whole procedure from the lab handout. Instead outline the general procedure that you plan to follow. Indicate what you will be measuring and equations that will be used for the analysis.
- 4. Complete the Pre-Lab**, in your notebook

*To be written in your lab notebook **DURING** lab:*

- 5. The Date** you performed the experiment and the **Names** of your lab partners
- 6. Data and Data Analysis** - Before making any measurements, think through the experiment and make a logical data table. The table should contain not only measurement values but also appropriate title and units. Never erase your original data. If you make a mistake, simply cross out (not erase!) the relevant data and enter the correct data. For each analysis you perform, make comments as to what you are calculating and why you need to do it. Always show a sample calculation. If you make a graph, attach a copy in your notebook.
- 7. Procedure Changes** - Note while you perform the experiment any changes made in the procedure. Include a labeled diagram of the set-up if it is not obvious. Keep in your mind that you may have to repeat the experiment again and you may be asked about your procedure on a lab quiz.
- 8. Conclusions** and any thoughts about the experiment (*e.g.*, special problems, suggestions for improvement). Make a concluding statement(s) about how well you accomplished the objective of the experiment.

There are two reasons for you to keep a journal for this class:

- If you plan on doing scientific work in the future, it's important to master the skill of keeping a good journal. The more you do it, the better you will become.
- A well-organized and complete journal will serve you well when you write lab reports, answer questions from your lab instructor during exit interviews, and take lab quizzes during the semester.

Physics 120 & Physics 130 Lab Report Format

Part I

Content and Format

The lab report is your personal record of the experiment you performed during the lab period. Serious effort should be made to write a careful and complete report according to the format that follows. Realize that the lab report needn't be a 30-page thesis; usually, four or five pages of text (not counting tables and figures) are sufficient to summarize purpose and procedure, report and interpret the data, and discuss the results of the experiment. The emphasis here is on effective communication: write clearly and be concise without omitting valuable information. The ultimate test of a good lab report is whether, a year from now, you or someone else can flip through its pages and understand the goals, methods, and outcome of the experiment.

Lab reports are to be typed using a standard 12-point font (Times New Roman is preferred). Double-space the text and use 1.0-inch margins. Figures (note that graphs are figures) and tables should be placed in the text where appropriate and not all clustered at the end of the report. The pages of the report should be stapled together.

There are many types of documents and reports required during your academic life (*e.g.*, science lab reports, essays, thesis), documents required as you transition to your career (*e.g.*, cover letter, CV), and still others during your career. The main point I'm trying to make here is that you must always supply what is requested if you intend to be successful. The lab report format required for this class may, or may not be, one that you are familiar with; it is, however, the required format.

Organization of the Lab Report

Your lab report will include the following sections. Include section headings (headings in bold) in your report. Section headings are separate from the section content that follows. Each of these sections is described more fully on the following pages.

- **Title Page**
- **Introduction**
- **Procedure**
- **Equations**
- **Data and Data Analysis**
- **Results**
- **Discussion of Results**
- **Conclusions**

Physics 120 & Physics 130 Lab Report Format

Title Page

State the title of the experiment, your name (underline it), the date you conducted the experiment and the date you submitted the report, and your lab partners' names.

Introduction

If you look at just about any scientific paper, the first few lines are an attempt to put the investigation into context. In particular, the authors indicate the motivation for the experiment (what question was the experiment trying to answer?) and explain why the experiment was important to do. Likewise, you should use the introduction to lay out, in a couple of sentences, the purpose of the experiment in a way that will capture the interest of the audience (remember who the audience is) without giving excessive information. Define all physics terms.

A couple of stylistic notes: First, the lab report should be written, for the most part, in past tense, since you are reporting on activities (measurements, analyses, etc.) that have already happened.

Second, use active voice rather than passive voice. (Example: “We measured the length of the string using a meter stick” versus “The length of the string was measured with a meter stick.”)

Procedure

Describe how you carried out your investigation. Highlight the main steps of the procedure (without going into excessive detail) and let the reader know what measuring instruments were used to obtain the data.

Include a sketch of the apparatus if you think it is appropriate (diagrams can be hand drawn, though we prefer computer-generated drawings). If you made a series of measurements over a range of adjustable experimental parameters, or if you needed to take elaborate precautions to get good data, you should explain this. **DO NOT** list the steps followed like a cook book!! Discuss the procedure in prose form.

Equations

The main equations, labeled, and how/why they were used (do not use measured values). Also, if certain quantities in your data tables or result tables are derived from other data, show the derivation.

Data and Data Analysis

Your experimental findings should be recorded neatly in the form of tables, graphs, or charts. Tables of data should be typed. Insert tables using your word processing software; do not insert sheets from a spreadsheet like Excel. Graphs are figures; they must be inserted into your report rather than attached at the end.

Tables and figures must be accompanied by explanatory text (the *caption*, italicized). Imagine you are making a presentation at a conference and you are projecting the graphs and tables onto a screen. Surely you would not display this information without comment! As a rule, then, every table and figure in your report should have a few words of associated text explaining the information. You must always include uncertainties.

Physics 120 & Physics 130 Lab Report Format

When presenting data in tables each column has a heading stating the quantity, the uncertainty of the quantity, and the unit of the quantity [*e.g.*, $v (\pm 0.03 \text{ m/s})$]. State the uncertainty and unit only in the column heading. All tables and figures should have a label (*e.g.*, “Figure 2”), a title (*e.g.*, “Position versus time for a falling ball”), and a caption. A caption will always be italicized. Include in the caption an explanation of what each variable represents (*e.g.*, v is glider speed).

Results

Organize the results (usually tables) as specified in lab (all tables and figures will include a label, title, and caption).

Discussion of Results

This is the most important part of the lab report. Discuss the significance of the results provided in the previous section. Link your experimental findings to the objectives described in your introduction. Did your investigation accomplish its purpose? Was the final outcome of your experiment consistent with your expectations? Have new questions been raised by your experiment? What were possible sources of error, or false assumptions, which may have skewed your results? Be sure to report what your data and analysis reveal, even if those results don't seem "right". There are real reasons - since we live in a world where laboratory equipment and experimental conditions are not ideal - why experimentally determined numbers and relations may come out "a little off", or even a lot off!

Conclusions

In a short paragraph or two, summarize the main things you learned from your experiment, make suggestions for improving the experimental procedure, and offer ideas for undertaking new lines of investigation. Did you verify the theory that you investigated? (Please note that at this level you did not ‘prove’ a theory. That may happen next year, though!)

Part II

Grading

Mechanics

Use of proper sentence structures, punctuation, and spelling

Organization

Report (or report section) follows required format; paragraphs coherent and focused on theme of each section; tables and figures are properly labeled and formatted

Content

Partial Report: Each section(s) appropriately addresses the material requested in the report format.

Full Report: Report clearly identifies the purpose and results of the experiment; thoughtful analysis and evaluation of data; adequate treatment of methods; all of the important data is included.