Syllabus

Course:	PHYS 151L, Section 10, Mechanics, Spring 2018
Lab Schedule:	Thursday, 12:00-14:50
TA:	Natalie Wohner
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Office Hours:	TBA, WAT421
Website:	http://go.hawaii.edu/j5u
Text:	Harris, General Physics Laboratory I: Mechanics: Physics 151L and 170L, 2nd Ed. (https://he.kendallhunt.com/product/general-physics-laboratory-i-mechanics-physics-151l-and-170l-ebook) or Harris, General Physics Laboratory II: Electricity and Magnetism Optics: Physics 152L and 272L, 2nd Ed. (https://he.kendallhunt.com/product/general-physics-laboratory-ii-electricity-and-magnetism-optics-physics-152l-and-272l-ebook)

Student learning outcomes:

- To understand the importance of experiment as the basis of the scientific method.
- Better understand physics concepts covered in lecture by seeing their application in experiments.
- To obtain experience in the techniques employed by scientists in all fields for analyzing data and drawing conclusions from "real world" experiments.
- Report your result in a scientific fashion.

Preparation for the lab:

- Use two bound notebooks.
- On the book's front cover print your name, class, section, and name of your TA. Also write table of contents at the beginning of each book, and have the pages numbered prior to use.
- Use a pen for all reports and quizzes (red, pink or orange colors not permitted).
- **Read the lab instructions for the upcoming lab and bring the lab manual to class.**
- Bring a scientific calculator, ruler, and tape.
- Wear closed shoes.

What to expect:

- The class will start most times with a **10-15min quiz**, potentially followed by a quick discussion of the answers.
- This is followed by a **30-45min lecture** from the TA. It is expected that the students interact a lot and ask questions. This will help to be more efficient when conducting the lab and writing the lab report.
- For the remaining ~2h, the students will **conduct the experiments** in groups of two and start the data analysis. Students should pay close attention to the instructions of the TA and the lab manual. Careful experimenting will result in better data. If something is unclear the TA is ready to help.
- Every lab is 2:50h long. You are expected to be on time and you are expected to stay until the end of the lab and to not leave early.
- A new random group partner will be assigned every two weeks.
- Nobody should leave without the TA signing your data tables.

Grades:

Lab reports:

- Each student is expected to perform all experiments. Please see the rules for make-up experiments below.
- The recorded data will be signed off by the TA. Data that was not signed off by the TA will not be accepted. Unsigned data tables will not be accepted in your report and potentially leads to 0 points for the report (which is equivalent to missing one lab).
- Reports must be handed over to your TA at the beginning of each lab. (During or after lab will be considered as late). Working on previous lab reports in class is strictly prohibited.
- The lab reports make up 60% of the grade. If a lab report is not submitted the grade for the experiment is 0%.
- Penalties for late reports:
  - 1 week – 15% off
  - 2 weeks – The report will not be accepted → **results in one missed lab**

Quiz:

- A ten to fifteen minutes quiz will be given every time.
- It will contain about five questions from the current lab and the previous lab.
- Be prepared for those quizzes by reading the relevant chapters from your manual. The quizzes make up 40% of the grade.

Final grades will be curved over all sections. The typical outcome over all sections is approximately 25% A's, 40% B's, 35% C's and below. Every experiment carries the same weight for the grade calculation.

Cheating:

- No cheating and copying is allowed. This includes copying data from another student.
- The groups will collaborate to conduct the experiment and also to start the initial analysis in the lab room together. However, the final analysis at home has to be conducted individually.
- No collaboration for quizzes.
- A student who was caught cheating would be given a zero for that lab/quiz (may also lead to a direct fail of the course).

Being late:

- This lab has a strict late policy. Missing parts of the lecture can potentially result in safety hazards and damaging behavior to the equipment.
- It is within the discretion of the TA to decide if a late student will be allowed to conduct the experiment or fail the experiment.
- Generally, being late by more than 30 min automatically results in a missed experiment. This lab has to be made-up if the late arrival was excused with a reasonable explanation. Without a reasonable explanation the lab cannot be made up and the student receives 0% for the experiment.

Missed Labs:

- To receive full credit, a student must inform (email) his/her TA before or immediately after the missed lab. The student is responsible for arranging for a make-up experiment. The TA will assist the student with this process. The TA is not responsible for contacting the student after a missed lab to schedule a make-up experiment.
- If the TA was not contacted on the same day and the student cannot produce a doctor's note or any other evidence the lab cannot be made up. In this case, the student receives 0% for the experiment.
- A total of **two** make-up experiments is allowed. Any further misses, will result in failing the course. Special circumstances requiring to soften this rule should be brought to the attention of the TA as soon as possible and will be decided on a case-by-case basis. The lab will be either made up in the other section of the TA or with another TA.
- In case of scheduling conflicts, it is the student's responsibility to make time for the make-up experiment. It cannot be expected that the TA will conduct the experiment exclusively with the student on their own time. Special arrangements will be found for missing a lab in the last week of the semester.
- On a case-by-case basis, the TA will decide if she/he will provide a make-up quiz as well.
- Making-up of missed labs will be in the same week or by the following week. If a student is excused for a longer period special arrangements will be decided on a case-by-case basis. This should be brought to the attention of the TA as soon as possible.
- **Only one lab can be missed without making it up to be able to pass the class.** This will result in a 0% score for both quiz and report. A second lab that is missed and not made up (see rules for make-ups above) will result in failing the course.

Lab Schedule by Week:

Building: Physical Science Building (PSB)

Date	Room	Group 1 - Experiments	Chapter in Lab Manual
1/18	108	Intro and discussion	1 and 2
1/25	108	Vectors	3
2/01	108	Discussion: Errors	4
2/08	108	Darts	5
2/15	108	Pendulum	6A
2/22	110	Air track	6B
3/01	110	Energy transfer in collisions	7A
3/08	108	Kinetic and potential energy	7B
3/15	108	Rotational motion	8
3/22	110	Natural oscillations	9A
4/05	108	Driven oscillation	9B
4/12	110	Liquid drag	10
4/19	108	Spring of air	11

Format of Report:

The idea of the report is that you could go back to report in a few months and would be able to repeat the measurements without any further instructions by only using your own report.

- Start with writing the experiment's **title and your partners' name/s.**

- Structure:

  - **Objectives:** The purpose of the lab. The objective part should be very short; it should not be longer than two or three lines. Write it in your own words.

    - What physical variable(s) are you determining?
    - What method(s) are you using?

  - **Procedure and Theory:** Write in your own words each step of your experiment. Do not copy the procedure from the lab manual. Draw a sketch of any apparatus and label the different components used in this experiment. Write and explain any derivations of formulas you used in this experiments as well as assumptions we made to modify these formulas. These are not the lecture notes!

    - Set-up
      - big sketch of experimental set-up(s)
      - label all parts of set-up (in terms of variables or labels)
      - use a coordinate system
    - Variables (in list format)
      - determine all variables you are using in the sketch and in any formulas used
    - Procedure (in list format)
      - describe the procedure(s) of the experiment(s)
      - what variables are you directly measuring and what tool are you using
    - Theory (in list format)
      - derivation of used formula from a very general formula (show all steps)
      - list of assumptions (under what conditions is the formula, that you derived, true?)
      - if necessary, show process of "linearization of equation"
        - Identify independent variable (x)
        - Linearize equation
        - Identify what you will plot on y-axis, identify slope and y-int.
        - Show how to calculate the variable of interest from this data

  - **Data, Calculations and Results:** Will include tables, graphs (Before printing any graph ask your TA to check the plot), and charts properly labeled with units. Please tape all extra papers to your notebook. The data should contain the information that was given and measured during the experiment (radii, mass, time, etc.).

- Data table (has to be signed off by TA)
    - includes title, labels, and correct units
- Example Calculations (for each formula, show one example)
    - Step 1: Equation with variables only (no numbers)
    - Step 2: Plug in numbers and correct units
    - Step 3: Final result with correct units
- Graph
    - includes title, labels, and correct units
    - experimental data sets include error bars (uncertainties), theoretical data points do not.
    - includes regression line (if applicable)
    - Instructions for GRAPHING SOFTWARE are handed out separately

- Calculations of final results
    - use data given in graph (slope and y-int.) to calculate variable of interest
    - show all three steps for all calculations (step 1: equation with only variables, step 2: numbers and units, step 3: result with units)

- **Final Results:** Write all your final results as follows: result ± uncertainty. Every measurement that you take has to be given with an error. Giving a measurement without the uncertainty has no physical meaning. Write **units** for all physical quantities. Not using units results in a deduction of points for your lab report.

    - Report experimental result (average ± uncertainty, correct units)
    - Give theoretical value (value, correct units)
    - Show calculations of precision and accuracy of experimental values

- **Discussion of errors:** briefly discuss in list format the main sources for systematic and statistical errors involved in your experiment and explain how it would change the experimental outcome:

    - for example:
        - observational error: human reaction time increases measurement of time period T and therefore leads to a lower experimental gravitational acceleration g than theoretically predicted.
        - theoretical error: the theoretical formula is only true under the assumption of a frictionless movement ....

- **Conclusion:** Write a conclusion in your own words. Explain whether the experiment fulfilled its objectives.

    - describe the overall learning outcome from the experiment
    - report the final result (average ± uncertainty, correct units)
    - discuss how well your experimental result agrees with the theoretical prediction

- **Questions:** Answer all questions assigned at the beginning of every class.