

General Physics I Laboratory
PHY-121 Fall 2023
Gustavus Adolphus College

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Course Objectives:

1. **Explore physical laws** applicable to kinematics, dynamics, oscillations, waves, thermodynamics, and fluid dynamics.
2. Learn to formulate and **test qualitative and quantitative hypotheses** for physical systems.
3. Acquire experience and skills in **making measurements and collecting data**.
4. Acquire experience and skills in **analyzing and reporting experimental data**.
5. Learn to apply basic **error analysis** and error propagation techniques.

Lab Materials:

- PHY-121 **General Physics I Laboratory Manual** available at the Book Mark.
- Two laboratory notebooks (5 x 5 quad ruled; Ampad, Roaring Spring, or equivalent brand recommended).
- A calculator.
- A flat straight edge or ruler for making charts and tables (optional).



Pre-Lab Exercises:



- All experiments in the lab manual are accompanied by a Pre-Lab exercise.
- The Pre-Labs will be in the form of a **Moodle assignment**.
- Moodle assignments are due (must be completed and submitted) **30 minutes prior to the start of lab each week**.
- Late submissions are **not** accepted by the Moodle server.



Lab Notebooks and Reporting:



- Students are encouraged to use physical lab notebooks for their experiments, but electronic notebooks are allowed at the discretion of the instructor.
- **Before each lab session**, prepare an objective statement, theory to be used, and a roadmap of the procedure in your notebook.
- **The lab notebook serves as a sequential journal of data collection procedure, observations, calculations, and analysis.**
- **Record all significant data and observations**, providing units and short descriptive phrases as labels.
- Hand-collected data should be recorded with units and short descriptive phrases as labels.
- Data collected via computer can be integrated into the notebook with descriptive information and units.



- Sketches and procedural information are essential to convey data collection methods.
- Record deviations, equipment malfunctions, or procedural stumbles as needed.
- **Lab notebooks also serve as containers for analysis, results, and answers to post-lab questions.**
- **Printed graphs must be taped into the lab notebook and annotated appropriately.**

Conclusions:

- Conclusions are an important part of hypotheses testing.
- Assess if measurements agree with the theory within the estimated uncertainty.
- Discuss possible reasons for any differences, such as characteristics of the physical system not accounted for or systematic measurement errors.
- Depending on the lab, you may refer to your answer instead of repeating it in the conclusion.
- **Conclusions should summarize the overall findings of the experiment.**
- **Reports are due at the beginning of the next scheduled lab period. A penalty of 10% per day will be assessed for each late lab report.**

Lab Report Outline:

1. Title, date, student name, and lab partner name.
2. A one or two-paragraph introduction of the principles to be explored and why they are interesting.
3. Theory to be tested.
4. A one or two-paragraph description of the methods to be used.
5. Detailed procedure, data, and observations.
6. Analysis and answers to questions.
7. Results (summary of findings).
8. Conclusions (Did it agree? If not, why?)

Lab Groups:

- Students will work in **groups of 2** (maximum of 3).
- All members must share in different aspects of the lab and become familiar with the equipment and procedures.
- Student roles are best rotated from week to week.



TA Grading: TAs are given the following outline for grading:

- Lab Report Rubric (10 points, use fractional (tenth point) values where needed)

Heading	A lab title, date of lab, name, and partner's name are clearly present at the beginning of the lab report. (0.5)	A lab title, date of lab, name, and partner's name are missing from the lab report. (0)		
Purpose	The introduction includes ALL of the following: The objective is clearly stated and accurately reflects the purpose of the lab. AND The physics principles covered in the lab are briefly discussed and include equations. AND A brief description of what was done to accomplish the objective is stated. (0.5)	The introduction includes one of the following mistakes: An objective is stated, but it does not accurately reflect the purpose of the lab. OR The physics principles covered in the lab are incorrectly discussed. OR A brief description of what was done to accomplish the objective is stated, but unclear. (0.4)	The introduction includes two of the following mistakes: An objective is stated, but it does not accurately reflect the purpose of the lab. OR The physics principles covered in the lab are incorrectly discussed. OR A brief description of what was done to accomplish the objective is stated, but unclear. (0.2)	The objective, physics principles, and brief description on what was done are not included in the lab report. (0)
Principles				
Roadmap				
Procedure	A description of what was done to accomplish the objective is clear enough so that the experiment could be reproduced. (3)	A description of the experiment is included but is not clear enough so that the experiment could be reproduced. (1.5)	The description of what was done is missing from the report. (0)	
Data	Data is complete and is presented clearly in tables. All proper units, significant figures, and error are included. (2)	Data is complete but may not be presented in a neat manner or is missing some proper units, significant figures, and error. (1.5)	Data is incomplete (missing measurements, observations, or given information). (0.5)	Data is not present in the lab report. (0)
Calculations/ Results/ Analysis	A sample of all calculations is correctly presented in a neat, orderly fashion with the remaining results clearly presented. All formulas and units are present. All analysis questions in manual are answered. (2)	A sample of all calculations is present but: includes minor errors, is not presented in a neat, orderly fashion, OR is missing formulas or units, OR some analysis questions in manual are unanswered. (1.5)	Some sample calculations are missing from the lab report, OR there are some major errors in the calculations, AND analysis questions are unanswered. (0.5)	The calculations are incomplete error or are missing from the report. (0)
Conclusion/ Discussion	The conclusion includes a discussion of the results and cites specific evidence, discusses the validity of the experiment including experimental error (e.g. t-test) , and suggests methods of improvement. (1)	The conclusion lacks one of the following: citing of specific evidence, OR discussion of validity/error, OR methods of improvements. (0.7)	The conclusion lacks two of the following: citing of specific evidence, OR discussion of validity/error, OR methods of improvements. (0.3)	The conclusion is grossly incomplete or is not present. (0)
Figures	Figures are correctly completed with title, labeled axes, units, fit, error bars, captions, etc. (1)	Figures are missing either a title, labeled axis, units, fit, error bars, or caption. (0.7)	Figures contain major errors. (0.3)	Figures are missing from the report. (0)

Preparation for Laboratory:

- Advance preparation is essential for efficient use of lab time.

- Students are expected to be thoroughly familiar with the purpose and general procedures of the experiment before coming to lab.
- Theory and procedure summaries should be prepared in advance and recorded in the lab notebook.
- **The Pre-Lab Moodle exercise encourages and rewards preparation for lab.**

Attendance:

- Students must arrange **in advance** to attend a lab at a different time if necessary.
- Consult with the instructor during the first week of the semester regarding anticipated absences due to field trips, athletic events, musical performances, or other activities.
- Making up a lab outside of a scheduled session is generally NOT possible due to equipment conflicts and logistical reasons.

Honesty:

- Students are expected to follow the Gustavus honor code and **pledge not to engage in unauthorized aid in completing their work.** Please ask if you have any questions about the appropriate use of another student's work.

Evaluation:

- **Pre-Lab Exercises** contribute **20%** to the final grade.
- **Lab Notebooks** contribute **80%** to the final grade
- A grade of **incomplete** will only be given for work not completed **due to circumstances beyond the control of the student.**

Final Grades:

- Final course grades will be assigned based on the following scale as a guide only:

A	94-100	A-	90-94	B+	86-90
B	82-86	B-	78-82	C+	74-78
C	70-74	C-	66-70	D+	62-66
D	58-62				

- Final grades may also take into account the instructor's evaluation of attendance, participation, effort, and evidence of improvement or regression.

Office Hours:

- **Each instructor will post their scheduled office hours outside their offices.**
- Students are encouraged to ask questions anytime the instructors are available.

Requesting Accommodations:

- Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students.
- Students with disabilities should contact the **Accessibility Resources Coordinator, Corrie Odland, (codland@gustavus.edu)**, to discuss and arrange accommodations.

Multilingual Student Support:

- Support is available through the **Multilingual and Intercultural Program Coordinator, Pamela Pearson (ppearson@gustavus.edu)**, for writing tutoring and connecting with support systems.

Mental Wellbeing:

- **Support services are available for mental health concerns and stressful** events that may create barriers to learning.
- You can learn more about the broad range of confidential health services available on campus at <https://gustavus.edu/counseling> and <https://gustavus.edu/deanofstudents/services>.

Title IX: Sexual Misconduct Prevention and Resources:

- **Gustavus Adolphus College promotes respect and is committed to providing an environment free of all forms of discrimination, harassment, and violence.**
- Resources and support are available at <https://gustavus.edu/titleix> for those who experience these behaviors.
- Please know that if you choose to confide in the lab instructors, they are mandated by the College to report to the Title IX Coordinator, because Gustavus and they want to be sure you are connected with all the support the College can offer.
- Although it is encouraged, you are not required to respond to outreach from the College if you do not want to.
- You may speak to someone confidentially by contacting the Sexual Assault Response Team (SART/CADA), Chaplains, Counseling Center, or Health Service staff; conversations with these individuals can be kept strictly confidential.
- SART/CADA can be reached 24 hours a day at 507-933-6868.
- You can also make a report yourself, including an anonymous report, through the form at <https://gustavus.edu/titleix>.