

Course Title/Number	General Physics I Laboratory / PHY 202					
Semester/Year	Spring 2018					
Days/Time	PHY 202-101 (CRN: 3678): Tuesday, 9:00-10:50 am PHY 202-108 (CRN: 3685): Thursday, 5:00-6:50 pm					
Location	Science Building Room 100					
Instructor	Dr. Howard L. Richards					
Office	Science Building Room 105					
Phone	304-696-6466 / Fax: 304-696-2494					
E-Mail	RichardsH@Marshall.edu					
Office/Hours		Monday	Tuesday	Wednesday	Thursday	Friday
	08:00 AM	PHY 203		PHY 203		PHY 203
	09:00 AM				Office Hours	
	10:00 AM	FYS 100	PHY 202	FYS 100		FYS 100
	11:00 AM	Office Hours				
	12:00 PM	Lunch				
	01:00 PM					
	02:00 PM			Office Hours		
	03:00 PM		PHY 101L			
	04:00 PM					
	05:00 PM				PHY 202	
	06:00 PM					
University Policies	<p>By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802</p> <p>Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment</p>					
Consumer Information and Disclosures	<p>To assist in locating federally mandated consumer information and disclosures, Marshall University has created a launching point at http://www.marshall.edu/disclosures/. Reports and information on a variety of specific areas, including financial aid, student privacy, student body diversity, the drug and alcohol abuse prevention program, employment and further education statistics for graduates, refund policies, and campus safety, are available from this website.</p>					

Course Description: From Catalog**General Physics 1 Laboratory. 1 hr. I, II, S.**

Laboratory to accompany PHY 201 or PHY 211, focusing on mechanics, concepts and applications.. 2 hrs. lab (CR: PHY 201 or PHY 211).

The table below shows the following relationships: How each student learning outcomes will be practiced and assessed in the course.

Students will ...	Practiced by ...	Assessed by ...
Perform experiments related to linear and rotational mechanics, oscillations, and waves.	(1) following along with the demos, examples, and explanations in the pre-lab lecture; (2) working steadily through the lab, so there is time to correct mistakes; (3) the difficulty and expectations for labs increase as students gain experience.	Lab Reports and Exam Questions.
Identify and (where possible) minimize the sources of experimental uncertainty.		
Use basic algebra to calculate physical quantities from experimental measurements.		
Convincingly argue whether the experimental measurements provide (subject to the known sources of uncertainty) quantitative support of accepted theory.		Lab Reports.

Required Texts, Additional Reading, and Other Materials

1. *Physics 202 Laboratory Manual*.
2. Recommended: *College Physics* by Urone, Hinrichs, Dirks, and Sharma, free in electronic form at <http://openstaxcollege.org/textbooks/college-physics>

Course Requirements / Due Dates

1. Lab reports / Due one week after the corresponding experiment is performed
2. Exam 1 / Regular lab time, Week of October 15
3. Exam 2 / Regular lab time, Week of December 3 (During Dead Week)

Grading Policy

60% Laboratory Report Average	A = 90+
20% Exam 1	B = 80-90-
20% Exam 2	C = 70-80-
	D = 60-70-
<u>Students who fail both exams will fail the class. This is departmental policy.</u>	

Attendance Policy

Students are expected to be on-time and present for all lab meetings. An attendance record will be maintained, with possible entries of **Present**, **Excused**, and **Absent**.

Students who are absent for any reason should attend a different section of the lab in order to make up the missed lab or test. **Students who have excused absences can do this at no penalty; students with unexcused absences will be subject to late penalties.** Make-up labs will be made available at the instructor's convenience; it may not be possible to provide them for all situations and/or at times convenient to all students. If it is impossible for an **excused** absence to be made up, that lab will simply be dropped from the average; if it is impossible for an unexcused absence to be made up, the student will receive a zero for that lab. Both excused and unexcused absences from tests must be made up, even if no later section is available.

Students with Disabilities

For University policies and the procedures for obtaining services, please go to MU Academic Affairs: University Policies and read the section, Students with Disabilities.
(URL: <http://www.marshall.edu/academic-affairs/policies/>)

Students with Medical Conditions:

In addition to the above, students with medical conditions, temporary or permanent, that may require special attention or accommodation (such as epilepsy) should inform the instructor as soon as possible.

Your privacy will be respected.

Academic Dishonesty:

“Academic Dishonesty is something that will not be tolerated as these actions are fundamentally opposed to ‘assuring the integrity of the curriculum through the maintenance of rigorous standards and high expectations for student learning and performance’ as described in Marshall University’s Statement of Philosophy.”¹ Cheating and other forms of academic dishonesty will bring serious sanctions, including possible expulsion. **Cheating on an exam will result at minimum in failing the entire course. You are encouraged to cooperate on the portion of the report covering in-lab activities, but do your own work on the homework part of the report.**

1 Ibid.

Course Schedule

Lab #	Week of ...	Description	Compare	
1	08/20/18	Static Force Vectors	Vector sum of forces	Zero vector
2	08/27/18	Intro to Motion	Velocity from stopwatch measurement	Velocity from sensor measurement
3	09/03/18	Accelerated Motion	Average acceleration (Activity 1-1)	Instantaneous acceleration (Activity 1-3)
4	09/10/18	Mathematical Description	Acceleration from v vs t	Acceleration from x vs t
			Initial velocity from v vs t	Initial velocity from x vs t
5	09/17/18	Projectile Motion	Measured range	Calculated range
6	09/24/18	Force and Motion	Mass of cart from graph	Mass of cart from scales
			Force of friction moving toward sensor	Force of friction moving away from sensor
7	10/01/18	Circular Motion	Measured centripetal force	Calculated centripetal force
8	10/08/18	Work and Energy	Measured net work	Measured change in kinetic energy
			Total mechanical energy at lowest point on track	Total mechanical energy at highest point on track
Exam 1	10/15/18	Covers Labs 1 – 6		
9	10/22/18	Collisions	Impulse	Change in momentum
Last Day to Drop 1 Course			Friday, October 26, 2018	
10	10/29/18	Simple Harmonic Motion	Spring constant from Force vs Displacement	Spring constant from period of oscillation
11	11/05/18	Periodic Motion of a Pendulum	Measured acceleration due to gravity (g)	Accepted $g = 9.8 \text{ m/s}^2$
12	11/12/18	Longitudinal Waves and Sound	Measured speed of sound at various frequencies	Speeds should be consistent with each other and $\sim 343 \text{ m/s}$
	11/19/18	Thanksgiving Break		
	11/26/18	Make-Up Labs/Review Sessions		
Exam 2	12/03/18	Covers Labs 7 – 12		

Advice for Succeeding in Lab**Before You Come to Lab:**

- Finish your lab report from the previous week. Lab reports are due **at the beginning of the lab period**. Do not wait until then to finish your write-up or worry about printing out your conclusion: a lab report that is submitted more than ten minutes after the official start of the lab will be marked late and **3 points** will be deducted.
- Read the section of the lab manual covering the experiment you are about to do.
- Find the corresponding material in your PHY 201 or PHY 211 textbook and read that, too. This will give you a better understanding of what the lab will be about.
- If students are not finishing labs, it is probably due to lack of preparation, and the instructor reserves the right to give a short (~5 minute) quiz at the beginning of any lab to test whether students are reading the lab manual. If the quiz is given, it will count for 25% of the lab report grade for that lab.

At the Start of Lab:

- Turn in your lab report from the previous week! Please staple the pages together, including your conclusion.
- If the computer is needed for the lab (as is usually the case), go ahead and log in. It takes the computer a few minutes to load all the software.
- **Make sure you know the full names of your lab partners.** It might be a good idea to get their email addresses or phone numbers, too, in case you realize later you are unclear on how something was done. Write your lab partner's **full names** on the front page of your lab report.
- Speaking of lab partners, each student should have at least one partner and no more than three, with two being the ideal. (When there is a problem with the equipment, **the instructor** may combine two groups, but this is exceptional.)
- For the most part, you may choose whatever partners yourselves. However, if necessary the lab instructor may break up or shuffle a team. This may happen because the team is goofing off or if everyone at the table seems to have too much difficulty understanding the material, in which case they would all benefit from being teamed with students who have a knack for physics lab. Please do not take offense if your team is split up.
- The instructor will usually give a brief overview of the experiment. Pay attention and take notes during this period of time; you should not be chatting or playing on the computer (games, emails, or social media). Above all, show respect to the instructor and the other students by not becoming a distraction. These rules also apply whenever the instructor addresses the class.

During the Lab:

- **Work safely.** Obey the safety instructions from the overview, and if something seems dangerous or you are not sure about it, ask!
- Work steadily. These labs can be finished in the time allotted, but not if you waste time.
- Concentrate on making the measurements. There may be questions that ask for a few sentences or a paragraph of explanation. Unless you can answer them quickly, leave those for later; if necessary, you can finish that at home. On the other hand, you only have access to the experimental equipment during the lab period.

- Take turns in the different experimental roles so that everyone understands the experiment. Everyone should be involved; freeloading is not allowed!
- Once you have completed your measurements, make sure to actually calculate the two things that must be compared (see the lab schedule for details). If the disagreement is large, you might need to check your methods and repeat some measurements.
- Do as much of the lab as time permits, including answering homework questions. It will be easier to answer questions when the lab is fresh in your mind and your partners are all together.
- Before you leave, show your work to the instructor. The first page of your lab report must be initialed by the instructor before you leave.

Writing Your Lab Report:

- In the space for “date”, indicate when your lab section begins (for example, “T @ 8”).
- The bulk of the report consists of pages you take from the lab manual. Each student is responsible for his or her own lab report, which should include all data and graphs.
- **Do** use the same data as your lab partners. **Do** help each other understand how to answer questions. **Do not** simply copy your partners' answers. **Do** write explanations in your own words. **Do not** copy answers from labs from previous semesters.
- Remember to show your work on at least one example of each kind of calculation.
- Each lab report must also include a typewritten conclusion consisting of three paragraphs. Handwritten conclusions will not be accepted. This part of your report is very important to your grade.
 - The first paragraph should be about **what the experiment was trying to do.**
 - THIS IS ABOUT THE GOALS OF THE EXPERIMENT AND WHETHER THEY WERE MET. DO NOT MERELY RESTATE THE PROCEDURE.
 - Consider the main comparison you are asked to make (again, see the schedule). Does this comparison test a principle, like the conservation of energy? Does it test an assumption, like the idea that the speed of sound is independent of frequency? Then this is what the lab is about; say so and say why in your first paragraph.
 - Also include in your first paragraph an explanation of what you measured and what you calculated to make the comparison. List the equation numbers. To reiterate: say what you measured, not how you measured it.
 - How good is the agreement? Does your experiment support (for example) the formula for the period of a pendulum?
 - If there is disagreement, can you account for it in terms of the experimental error (discussed in the second paragraph)?
 - The second paragraph should be about **experimental error.**
 - **EXPERIMENTAL ERROR IS NOT SLOPPINESS OR CARELESSNESS. IT IS THE UNAVOIDABLE UNCERTAINTY INHERENT IN THE EXPERIMENT.** For example, experimental error can be due to human reaction time when operating a stopwatch, the limited precision of a protractor for measuring angles, a track that is not level, a spring launcher that is not perfectly consistent, etc. Pay attention in the overview for help with this.
 - Identify the sources of error for your measurements.
 - If you can, give a quantitative estimate for the uncertainty in your measurement.

- If you can, use error propagation to give a quantitative estimate for the uncertainty in your calculated quantities.
- Finally, you need to write a “Conclusion”. This is where you state what was learned in the lab – that is, did you achieve the goals specified in the Objective? **Think of the lab as an episode of *Mythbusters*.** The myth is that the theory, as presented in your textbook and lab manual, is correct. Is the myth busted, plausible, or confirmed? (It should be confirmed!)
- How good is the agreement? Does your experiment support the idea that energy is conserved, or whatever the Objective was trying to establish?
- If there is disagreement, can you account for it in terms of known sources of experimental error?

Each lab report will be graded on a 10 point maximum basis. **The completed reports are to be stapled and turned in at the immediate beginning of the next lab class.** An unexcused absence results in a zero for the that lab. **The lowest lab report will be dropped from the average.**

For Additional Help:

- If you find yourself struggling, **let the instructor know**. Feel free to drop by during office hours – that's what they are there for!
- It may also be a good idea to study with other students taking the same course, even if they are in a different section.
- A very good online tutorial for intro physics can be found at the HyperPhysics web page: <http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.htm>.
- The Physics Department has a page of tutorial links, including “in house” tutoring at <http://www.marshall.edu/physics/tutoring.asp>.
- There is also a tutoring center in Laidley Hall. See <http://www.marshall.edu/wpmu/uc/tutoring-services/> for details.
- Finally, a number of helpful explanations can be found at <http://www.nagt.org/nagt/jge/columns/compgeo.html>. That site is targeted at computational geology, but many of the ideas apply directly to physics.

Classroom Behavior:

Disorderly conduct that interferes with the normal classroom atmosphere will not be tolerated. The classroom instructor is the judge of such behavior and may instruct a disorderly student to leave the room with an unexcused absence. More serious misconduct may result in a complaint to the Office of Judicial Affairs. “Official University action will be taken when a student’s or student group’s behavior violates community standards, interferes either with the University’s educational purpose, or with its duty to protect and preserve individual health, welfare, and property. When the behavior is aggravated or presents a continuing danger to the University community, accused students are subject to separation from the institution.”²

² *Student Handbook*, available at www.marshall.edu/student-affairs/sections/handbook/INDEX.HTML