

Course information

PHY-170-001 (General Physics II)

Course prerequisites: high school algebra, trigonometry, vectors and some calculus (simple differentiation and integration); physics at the level of PHY 120 (or equivalent exposure to physics) is a prerequisite

Instructor: Rafid Mahbub

TA and grader: TBA

Office: Olin Hall 212

Contact: mahbub@gustavus.edu; or talk to me after class; or drop by the office with/without notice (if I'm there)

Office hours: T W Th F (for an hour after lecture)

Lecture schedule: Lecture hours are 10:30 am to 11:20 am every **Monday, Tuesday, Wednesday, Thursday** and **Friday** in **Olin Hall 103**. We will use one (or two) of these lecture days, every week, as discussion-styled group work sessions where you will be solving problems involving topics covered during the week. Except for quiz weeks, group work sessions will be held every **Friday**.

Quiz and final exam information

Throughout the semester there will be four quizzes, out of which the best three attempts will contribute towards the final score, and a final exam. The quizzes will be held on **Fridays**. Please refer to the schedule for dates. There will be a two hour final on Saturday, May 18 from 3:30 am to 5:30 pm.

Textbooks and references

For an introductory physics course such as this, many excellent textbooks are available. I will use the following for the course

1. [Samuel J. Ling, Jeff Sanny, William Moebs, University Physics Vol. 2, Openstax](#)
2. [Samuel J. Ling, Jeff Sanny, William Moebs, University Physics Vol. 3, Openstax](#)

Please use the clickable links to access online versions of these textbooks. These are free to use and do not require any subscriptions or fees.

Course goals and objectives

After the end of the course, the general expectation is that the students will have learned enough physics to describe phenomena in biology and chemistry using simple laws of physics. I use the term *simple* since this is an introductory course. Despite the simplicity, the overarching goal of

the course is to develop the skills necessary so that the students can describe different phenomena around them using the physics that they have learned in a simple and quantitative fashion.

To that end, great importance is placed on problem-solving and, more importantly, identifying effectively how certain problems can be solved. We need to bear in mind that what are termed as *problems* in the context of a regular course are by no means very complicated problems. Such problems take a great deal of time to solve and this is not an international competition which measures the problem-solving skills of students. Rather, what the course, in general, will attempt to do is make you well-versed at using laws of physics (and some maths) to solve problems, making you proficient such that you are able to deal with them when they are scaled up and made more complicated.

It is also an expectation that, by the time the course ends, you will be able to communicate ideas and concepts regarding your physical reality in a more scientific and quantitative fashion and, maybe, with a bit of abstraction as well.

Since this course is aimed towards students of biology and chemistry, it is crucial that the physics is linked with these subjects in a way which appears intuitive without being overwhelming. This is not an easy task to accomplish for an introductory physics course. However, we will attempt to bridge these fields by discussing various phenomena in biology and chemistry through the lens of physics.

Grading

The letter grade distributions are given below. This may change in the future depending on how the class performs overall. The overall grade will be broken down as follows

Weekly homework: 30%

Quizzes: 30%

Final: 40%

A	>90%
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A	≥85%
-	

to

<90%

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B +	$\geq 80\%$
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to

$< 85\%$

B	$\geq 75\%$

to

$< 80\%$

B -	$\geq 70\%$

to

$< 75\%$

C +	$\geq 65\%$

to

$< 70\%$

C	$\geq 60\%$

to

$< 65\%$

C -	$\geq 55\%$

to

$< 60\%$

D +	$\geq 50\%$

to

$< 55\%$

D	$\geq 45\%$

to

<50%

F	<45%

Tentative weekly schedule

This will be subject to change depending on the pace of the lectures.

Schedule

Week	Topics covered
02/05 - 02/09	Introduction to electrostatics <ul style="list-style-type: none">• electric charge; conductors and insulators• Coulomb's law; electric fields• electric fields from continuous charge distributions• electric dipoles
02/12 - 02/16	Electric fields produced by symmetric charge distributions and Gauss's law
02/19 - 02/23	Electric potential <ul style="list-style-type: none">• electric potential and associated potential energy• calculation of electric potential from charge distributions• equipotential surfaces and conductors• calculation of electric field from potential Quiz 1 on 02/23/2024
02/26 - 03/01	Capacitance <ul style="list-style-type: none">• capacitors and capacitance; capacitors in series and parallel• energy stored in capacitors; capacitors with dielectrics
03/04 - 03/08	Current and resistance <ul style="list-style-type: none">• electrical current and conduction• resistivity and resistance; Ohm's law• electrical energy and power
03/11 - 03/15	Direct-Current circuits <ul style="list-style-type: none">• circuit elements;• EMF; resistors in series and parallel• Kirchhoff's rules• RC circuits Quiz 2 on 03/15/2024
03/18 - 03/22	Magnetic fields and forces <ul style="list-style-type: none">• magnetic force on a charged particle and current carrying wire• Lorentz equation• torque of current carrying loops

03/25 - 04/29	Sources of magnetic fields <ul style="list-style-type: none"> • Biot-Savart's law • Ampere's law
04/01 - 04/05	Electromagnetic induction <ul style="list-style-type: none"> • Faraday's law • Lenz's law • motional EMF
04/08 - 04/12	Electromagnetic waves <ul style="list-style-type: none"> • EM wave phenomena; wave polarization • EM wave spectrum • energy carried by EM waves • momentum and radiation pressure Quiz 3 on 04/12/2024
04/15 - 04/19	Geometric optics and image formation <ul style="list-style-type: none"> • laws of reflection and refraction; Huygen's principle • image formation by reflection • image formation by refraction; thin lenses and applications
04/22 - 04/26	Physical optics: interference and diffraction <ul style="list-style-type: none"> • double-slit interference • multiple-slit and thin film interference • diffraction
04/29 - 05/03	Quantum physics <ul style="list-style-type: none"> • survey: blackbody radiation, photoelectric effect, Compton effect • wave-particle duality • failure of the classical atom: Bohr's model Quiz 4 on 05/03/2024
05/06 - 05/10	Nuclear physics <ul style="list-style-type: none"> • elementary concepts on nuclear physics and decay • medical applications
05/13 - 05/17	<ul style="list-style-type: none"> • Special topic: RC circuits and modeling neurons (simplified Hodgkin-Huxley model)

Gustavus Adolphus College Honor Code

The overarching principle of the Academic Honesty Policy is that students shall submit their own work, in fairness to others and to self. Your professor wants you, a developing scholar, to be able to take pride in your own academic work and to maintain your academic integrity. Citations must accompany any use of another's words or ideas that are not common knowledge. Quoting or paraphrasing from electronic sources without proper citation is as serious a violation as copying from a book or other printed source. A student may not submit work that is substantially the same in two courses without first gaining permission of both instructors if the courses are taken concurrently, or permission of the current instructor if the work has been submitted in a previous semester. Ask your professor if you have questions about a particular assignment or kind of

work. Please make sure you fully understand the rules related to online work, as it pertains to this course. Unauthorized aid during online exams and assignments is every bit as serious and inappropriate as it would be in an in-person course. In fact, in the online environment it is sometimes easier for faculty to detect violations.

The sanction in this course for a violation of the Honor Code involving plagiarism, copying another student on an exam, or other kinds of cheating on a single assignment will usually be an “F” on the plagiarized assignment or exam. For a more significant event, I, your professor, reserve the right to assign you a grade of “F” for the course. In addition, for any Honor Code violation, I will notify the Provost’s Office. A letter will be generated by the Provost’s Office and sent to you. The letter will remain on file. There will be no further consequence, beyond the course penalty and the letter, if you do not commit any further Honor Code violations. Repeat offenses could ultimately lead to dismissal from the College. You have the right to appeal any Honor Code violation through an Honor Board hearing process. In this course, your professor aims for you to learn how to cite sources properly, do your own work on all exams, and function as a scholar with integrity. Please feel welcome to ask questions about the important matter of Academic Honesty and let me know how I can best support your learning.

For detailed information, please refer to the following link under **Academic Information and Policies**

https://gustavus.edu/general_catalog/21_22/academic_bulletin_21_22.pdf

Academic Accommodations

Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students. If you have a disability and anticipate or experience barriers to equal access, please speak with the accessibility resources staff about your needs. A disability may include mental health, attentional, learning, chronic health, sensory, physical, and/or short-term conditions. When appropriate, staff will guide students and professors in making accommodations to ensure equal access. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact them as early as possible. Accessibility resources staff are located in the Academic Support Center (<https://gustavus.edu/asc/accessibility/>) (x7227). Accessibility Resources Coordinator, Corrie Odland (codland@gustavus.edu), can provide further information.

Academic Accommodation for Religious Observance

A student whose religious observance conflicts with a course requirement may request an academic accommodation from the instructor. Students should normally make such requests in writing by the end of the second week of classes, but there may be exceptions. Students may also request accommodations for religious traditions surrounding death and dying when the need arises. The Chaplains' Office annually publishes a multifaith holiday calendar with

accommodation notations. You can find it here: <https://gustavus.edu/chaplain/multifaith/>. However, this list is not exhaustive and observances are not necessarily days when individuals will not attend work or school. There are also different levels of observance in different traditions. The Chaplains' Office is available for consultation on any requests for accommodation that are not included in their calendar.

COVID Resources

Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students. If you have a non-disability-related academic concern related to COVID for which you are not already receiving assistance from the Academic Support Center, please contact the Provost's Office (provostoffice@gustavus.edu). When appropriate, the Provost's Office will help guide students and faculty in making any necessary academic adjustments.

Multilingual Student Support

Some Gusties may have grown up speaking a language (or languages) other than English at home. If so, we refer to you as "multilingual." Your multilingual background is an incredible resource for you, and for our campus, but it can come with some challenges. You can find support through the Center for International and Cultural Education's (<https://gustavus.edu/cice/>) Multilingual and Intercultural Program Coordinator (MIPC), Pam Pearson (ppearson@gustavus.edu). Pam can meet individually for tutoring in writing, consulting about specific assignments, and helping students connect with the College's support systems. If you want help with a specific task (for example, reading word problems on an exam quickly enough or revising grammar in essays), let your professor and Pam know as soon as possible. In addition, the Writing Center (<https://gustavus.edu/writingcenter/>) offers tutoring from peers (some of whom are themselves multilingual) who can help you do your best writing.

Mental Wellbeing

The Gustavus community is committed to and cares about all students. Strained relationships, increased anxiety, alcohol or drug problems, feeling down, difficulty concentrating, and/or lack of motivation may affect a student's academic performance or reduce a student's ability to participate in daily activities. If you or someone you know expresses such mental health concerns or experiences a stressful event that can create barriers to learning, Gustavus services are available to assist you, and include online options. 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 recognizes the dignity of all individuals and promotes respect for all people. As such, we are committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, domestic violence, dating violence, and stalking. If you (or someone you know)

has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available; you can learn more online at <https://gustavus.edu/titleix/>.

Please know that if you choose to confide in me, I am required by the College to report to the Title IX Coordinator, because Gustavus and I 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/>.