

# General Physics 1–Honors (PHYS 101H): Fall 2023

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## Contact details

**Course Instructor** Prof. Chris Monahan. My pronouns are he/his/him. Email is the best way to contact me, although you are always welcome to drop by my office, Small Hall 326C. I am not typically on campus on Tuesdays.

**Contact email** [cjmonahan@wm.edu](mailto:cjmonahan@wm.edu).

**Course webpage** is [cjmonahan.net/phys101h\\_2023](http://cjmonahan.net/phys101h_2023) and on Blackboard.

**Office hours** (preliminary) In person on Thursday 2:00-3:00 pm and Friday 3-3:30 pm. I will also be in my office Monday 10:00-10:30 am.

**Be aware** This syllabus is subject to change during the semester. I will announce changes in class, but you are responsible for keeping up to date with the latest version on the course webpage and on Blackboard.

## Course overview

### College dates

- Add/Drop deadline: 11:59 pm on Monday September 11
- Midterm grading period: Monday October 9 to Sunday October 29
- Withdrawal deadline: 11:59 pm on Monday October 30.

### University holidays (no classes!)

- Monday September 4 (Labor Day)
- Tuesday November 7 (Election day)
- Thursday October 12 and Friday October 13 (Fall break)
- Wednesday November 22, Thursday November 23 and Friday November 24 (Thanksgiving)

In addition, there are no classes on

- Wednesday November 8

Finally—class on Monday November 20 will be remote (via Zoom). In fact, **all** classes on Monday November 20 and Tuesday November 21 are remote.

**Class schedule** This course will be delivered in person in Small Hall 111 at **11:00 to 11:50 am** on Mondays, Wednesdays and Fridays, and in Small Hall 111 at **3:30 to 4:20 pm** on Thursdays. Classes will not be streamed via Zoom.

**Prerequisites** Prior exposure to calculus will be assumed. This means you should be comfortable with the definition of derivatives and one-dimensional integrals (including the mathematical sense of “anti-derivatives”). You should be able to calculate derivatives and integrals of simple functions of one variable, including polynomials and basic trigonometric functions. Co-registration in the laboratory PHYS 101L is not required, but **strongly** encouraged.

**Laboratory** The laboratory (PHYS 101L) is a separate one-credit course. It is possible to take PHYS 101H without taking the lab, although I recommend you take both in the same semester. PHYS 101L is required for physics majors and minors. The lab cannot be taken without either being enrolled in the lecture class or having previously passed PHYS 101 or PHYS 101H.

**Assessments** There will be weekly Problem Set assignments, two midterm exams, and a final exam. In addition there will be weekly in-class quizzes. You will receive credit for taking quizzes and you can **choose** whether quizzes will constitute part of your final grade. There are two scenarios and in both scenarios, your final numerical grade will be calculated two ways.

**Scenario 1** You wish to include the weekly quizzes as part of your final grade. The grades will be calculated based on one of two options:

- |                       |           |                       |
|-----------------------|-----------|-----------------------|
| • Problem Sets : 35%  | <b>or</b> | • Problem Sets : 35%  |
| • Weekly Quizzes : 5% |           | • Weekly Quizzes : 5% |
| • Midterm Exams : 30% |           | • Midterm Exams : 10% |
| • Final Exam : 30%    |           | • Final Exam : 50%    |

**Scenario 2** You do not wish to include the weekly quizzes as part of your final grade. The grades will be calculated based on one of two options:

- |                       |           |                       |
|-----------------------|-----------|-----------------------|
| • Problem Sets : 40%  | <b>or</b> | • Problem Sets : 40%  |
| • Midterm Exams : 30% |           | • Midterm Exams : 10% |
| • Final Exam : 30%    |           | • Final Exam : 50%    |

For each student, in both scenarios, the final grade will be calculated using both methods, and the result with the larger numerical grade will be the one used to determine the letter grade.

This procedure allows those students that had difficulty with one or more of the midterm exams to have the chance to make up for it with a good performance on the final exam; after all—what is relevant is how much physics you have learned at the end of the course!

**Problem sets** Problem Sets will be posted on **Blackboard** on **Wednesday before class** and are due by the start of class the following Wednesday (that is, by 10:59 am). **I will drop the lowest grade on your weekly Problem Set.**

**Midterm exams** There will be two midterm exams. The first will take place on **Wednesday October 4**, during class time, and the second will most take place on **Monday November 6**.

**Final exam** The final exam schedule will take place from **9 am to 12 midday** on **Monday December 11**. The final exam dates are centrally scheduled and, once decided, **tend not to change**.

If you know you will miss an exam due to an university sanctioned event, please notify me by email prior to the exam. If you are ill on the day of the exam, please contact me as soon as possible to make other arrangements. A make-up exam may be administered.

**Required materials** We will use the (free) *Open Stax University Physics* textbook by Ling, Sanny, and Moebs. This text is accessible online [here](#). You will also need an **Expert TA online subscription** for homework submission. To register for the course on **Expert TA**, you need this link: <http://goeta.link/USA48VA-D4C26A-34S>. The cost is approximately \$33 per course, per semester. Expert TA is also available through the bookstore (the title is “Expert TAs Intro to Physics” and the ISBN is 9780996164696).

If you would like another reference textbook, which may be useful in future semesters if you plan to major in physics, then I would recommend either *Physics for Scientists and Engineers with Modern Physics*, by Serway and Jewett (Cengage Learning) or the super-classic *Fundamentals of Physics* by Halliday, Resnick and Walker (Wiley). Both of these textbooks have many many editions, and I believe the latest versions are the 10<sup>th</sup> and 12<sup>th</sup> editions, respectively. Printed copies of the latest versions can be very expensive, however. If you do wish to buy a printed copy for future reference, I would not recommend buying the latest versions: slightly older editions can be purchased secondhand much more cheaply with much of the same material.

This is not a textbook, but I think that *The New Science of Learning* by Todd D. Zakrajsek (3<sup>rd</sup> edition, Routledge) is a great book, with a lot of helpful information for making the most of your university experience. It outlines things like how to learn to learn effectively, how to think about time management and other useful skills, and how to navigate the hidden curriculum of college.

## Course description

This course is an introduction to topics in classical mechanics, including Newton’s Laws, conservation of energy and momentum, angular motion, gravitation, fluid mechanics, and wave motion. This course is for students who intend to major in physics or mathematics and other physical sciences and offers a more in-depth treatment of topics covered in PHYS 101, with more sophisticated examples. Prior exposure to calculus will be assumed. This means you should be comfortable with the definition of derivatives and one-dimensional integrals (including the mathematical sense of “anti-derivatives”). You should be able to calculate derivatives and integrals of simple functions of one variable, including basic trigonometric functions. We will use simple Taylor series in this course and introduce some aspects of multi-variable calculus.

We will cover:

1. Motion in one, two, and three dimensions.
2. Forces and Newton’s laws of motion.
3. Work, energy, and power.

4. Momentum and elastic and inelastic collisions.
5. Angular motion, angular momentum, and moments of inertia.
6. Gravity, Newton's laws of gravitation, and Kepler's laws.
7. Fluid mechanics, Pascal's law, and Bernoulli's equation.
8. Simple harmonic motion, circular motion, and damped oscillators.
9. Waves, wave equation, and standing waves.
10. Sound waves and the Doppler effect.

We will also have time to discuss some more advanced topics that are not examinable, such as special relativity and quantum mechanics.

### **Accommodations and Student Accessibility Services**

William and Mary accommodates students with disabilities in accordance with federal laws and university policy. Any student who feels they may need an accommodation based on the impact of a learning, psychiatric, physical, or chronic health diagnosis should contact Student Accessibility Services staff at 757-221-2512 or at [sas@wm.edu](mailto:sas@wm.edu) to determine if accommodations are warranted and to obtain an official letter of accommodation. For more information, please see the Student Accommodation Services [website](#).

### **Course policies**

The following policies are founded on two tenets:

1. You are responsible for your own learning.
2. You have agreed to abide by the Honor Code.

Some aspects or details of these policies are open for revision during the semester, if we, as a class, feel that they are not working. These two tenets, however, are not.

### **Honor Code**

As students at William and Mary you have agreed to abide by the [Honor Code](#). You are responsible for your behaviour in class and are expected to uphold the Honor Code.

### **Responsibility for learning**

You are responsible for your own understanding of the course material. We may all learn in different ways, and I aim to foster an environment that allows us all to learn effectively. Taking responsibility for your own learning guides the following policies.

**Working together** You are encouraged to work together for problem sets, but you must provide your own solutions. Collaboration helps develop and cement understanding of the material, and is an important skill for your future careers, whether in physics or not. Your problem set submissions, however, should represent your own understanding and we must strike a balance between working collaboratively and copying someone else's work. I cannot emphasise this enough: **Copying solutions will not help you understand this course**. Moreover, copying is cheating and a

form of plagiarism. An example of appropriate collaboration is working together to sketch out the main steps in a derivation or in the solution to a problem, then going away to write up your solutions in detail separately. An example of cheating is taking someone else's solutions the night before the deadline and copying them line by line.

**Attendance** Attendance does not form part of the grade for this class. After all, you are responsible for your own understanding of the course material. Attending class will, however, significantly improve your enjoyment of the course and is *highly* likely to improve your satisfaction with both your own understanding and your grade. In practice, it is extremely hard to obtain a good grade in this course without attending class.

I appreciate it if you are able to let me know if you will be absent from class, either because of other commitments or for health-related reasons, but this is **not required**. All course materials, including the slides, will be available on the course webpage and on Blackboard after class. Office hours are the best place to come with questions about material from classes that you missed. If you would like to make arrangements to catch up on missed classes outside of office hours, or if you will have an extended absence, please let me know and we can try to make appropriate arrangements.

**Late work, extensions, and make-up exams** I can make occasional accommodations for late homework if you inform me in advance. Reasons are appreciated, but not necessary, because sometimes you may not wish to share your reasons with me, for, you know, personal reasons. As with all these policies, I expect you to treat this responsibly. Sudden emergencies and unexpected life events will obviously be accommodated appropriately.

If you know you will miss an exam due to an university sanctioned event, please notify me by email prior to the exam. If you are ill on the day of the exam, please contact me as soon as possible to make other arrangements. A make-up exam may be administered.

**Laptops and mobile devices** You are welcome to bring laptops and mobile devices to class and are responsible for their appropriate use. Please note, however, that there is significant evidence (see, for example, [here](#), [here](#), and [here](#)) that using your device for tasks that are not related to in-class activities will (significantly) impinge on your understanding of the course material and perhaps even your grade. Distracting other students is not appropriate use.

**Typewriters** Typewriters are not permitted in the classroom.

**Artificial Intelligence** Artificial Intelligence (AI) or machine learning—think ChatGPT, Dall-e etc.—is a reference tool like any other. Well, not quite like any other, but AI is like other references and tools in the important sense that AI can be used well or AI can be used poorly. Based on the principle that you are responsible for your own learning, you may choose to use AI-based tools, such as ChatGPT, in this course if you wish, but I caution you that the results are **NOT ALWAYS CORRECT**. Trust me on this, I have tried feeding ChatGPT homework questions<sup>1</sup> and sometimes they are Just. Plain. Wrong. The difficulty for anyone that uses ChatGPT in this

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<sup>1</sup>I fed ChatGPT all three questions from Problem Set 2 and it got just one part of one question correct, although the intermediate steps for its incorrect answers looked plausible.

course is that it is very hard to tell whether the solutions are correct or not; they certainly look correct, even when they are not.

Copying solutions from ChatGPT directly into your own problem solutions (whether on Expert TA or the handwritten problems) is plagiarism and is a violation of the Honor Code, like any other form of plagiarism. An example of the reasonable use of ChatGPT is rather like using something from the textbook: reading through the solution, making sure you understand and can explain each step and then writing it in your own words and with your own choice of mathematical notation, when appropriate.

A third disadvantage of using ChatGPT, rather than, say, talking to a classmate, is that you do not get the meaningful dialogue that comes from sharing ideas with fellow physicists, explaining your understanding and learning from theirs. Working together with your classmates will help you learn a lot more than ChatGPT or any other AI-based tool can.

Finally, remember that you will only get better at physics if you practice problem solving. Using ChatGPT to solve problems is not at all the same as solving problems yourself and it will not help you when it comes to exam time. The best way to do well in this course is to come to classes, attempt all homework problems, work with other students in the course, and, above, practice as many physics problems as you can.

### **Undergraduate research**

William & Mary is well-known for its extensive undergraduate research. I strongly encourage you to take advantage of the different opportunities across campus!

For an overview of research opportunities on campus, I recommend you start with the [Undergraduate Research Events](#) webpage.

The Charles Center provides many service and opportunities associated with undergraduate research. In particular, there is summer research funding available through the Charles Center. There is a competitive application, typically due in the Spring semester, that requires you identify a research project and a supervisor that will support your application. Not all applications can be funded, but don't be discouraged if you don't succeed first time—try again next year! If you have questions about job opportunities on campus, included funded research, and Federal Work Study, then start [here](#) and email [studentemployment@wm.edu](mailto:studentemployment@wm.edu) if you have specific questions.

In the Department of Physics, specifically, there are two broad types of research: research undertaken during the semester, for which you should receive course credit (for example, in your second year you would register for “PHYS 255: Sophomore Research”, with the option to take between one and three credits); and research undertaken during the summer, for which you should be paid. Summer research funding may be provided through your research advisor's grant or through the Charles Center. Not all faculty in the department will have opportunities or funding for undergraduate summer research. To the best of my knowledge, there is no centralised database of research opportunities in the department. You must identify a possible supervisor yourself, either through courses you take or through the departmental [website](#). Note that in the Spring semester, there is a one-credit course called “Seminars in Physics” (PHYS 212), which will help introduce

you to many of the areas of research in the department.

### **Library resources**

William & Mary Libraries offers free research assistance to all students at W&M. Research librarians hold a graduate degree in library science and are trained to help users find, evaluate, and ethically use high-quality sources for their research projects. You can make an appointment by visiting the libraries [website](#). Students can also receive drop-in research help during business hours by visiting the front desk of Swem Library or live chat with a librarian through the website.

### **Student organisations**

There are a number of organisations, societies, and other opportunities to have some physics fun. I encourage you to check some of these out:

1. Society of Physics Students. Join as a member via tribe link page: [here](#).
2. Women in Physics group. Contact Prof. Novikova using [inovikova@physics.wm.edu](mailto:inovikova@physics.wm.edu).
3. Mentoring for Careers in Physics (MCP). Professional mentoring for students from minoritized genders in science that are interested in STEM careers. Contact me or Prof. Yang using [rxyan2@wm.edu](mailto:rxyan2@wm.edu).

### **More student resources**

I recognise that, as college students, you juggle different responsibilities and can face challenges that make learning difficult. There are many University resources available to help you navigate emotional, psychological, physical, medical, material and accessibility concerns. Asking for help is a sign of courage and strength. If you or someone you know is experiencing any of these challenges, I really encourage you to reach out to the following offices:

- For psychological/emotional stress, please consider reaching out to the [W&M Counseling Center](#); or (757) 221-3620, 240 Gooch Drive, 2nd floor. Services are free and confidential.
- For physical/medical concerns, please consider reaching out to the [W&M Health Center](#); or (757) 221-4386, 240 Gooch Drive.
- For additional support or resources, please contact the Dean of Students by submitting a [Care Report](#); or by calling 757-221-2510, or by emailing [deanofstudents@wm.edu](mailto:deanofstudents@wm.edu).

Please reach out to me if you are facing challenges inside or outside the classroom; I can help guide you to appropriate resources on campus, some of which are listed below (links in online PDF):

- [The Dean of Students and the Student Success office](#).
- [Student Accessibility Services](#)
- [Writing Resource Center](#)
- [Equity program](#)
- [LGBTQ resources](#)
- [Neurodiversity Initiative](#)
- [Health and Wellness, mental health resources and the Counseling Center](#)

- [The Haven](#)
- [Lifeline](#)
- [Options for reporting Discrimination, Harassment, Retaliation and Sexual Misconduct.](#)

For quick access, you can also use the QR code in the figure below



The full policy of the College on Discrimination, Harassment and Retaliation is [here](#).