

Syllabus for PHYS3370: **Order of Magnitude Physics**, Fall 2024

Course meetings: MW 12pm-1:29pm in [DRL](#) ([building access](#))

Instructor: [Prof. Robyn Sanderson](#) - [Office](#): DRL 4N10

By the end of the course, you will be able to:

- A. Use order-of-magnitude estimates to determine the sizes of different physical scales and effects
- B. Determine the dimensions of an equation or quantity and know when a numerical answer is dimensionally consistent
- C. Derive and use scaling relations for physical quantities
- D. Explain the symmetries present in an equation relating physical quantities and what their physical implications are
- E. Assess the relative contributions of different statistical uncertainties to a measurement or calculation

Table of contents

[You will need](#)

[Course components](#)

[Communication](#)

[Course schedule](#)

[Getting Help](#)

[Academic Integrity](#)

[Evaluation](#)

[Grading summary](#)

It's important to me that everyone who wants to participate has the [resources](#) to be fully included in this course. Please let me know if you need special accommodations in the curriculum, instruction or assessments of this course to enable you to participate fully. I will make every effort to maintain the confidentiality of the information you share with me.

Penn provides reasonable accommodations to students with disabilities who have self-identified and been approved by [Student Disabilities Services](#) (SDS). If you have not yet contacted SDS and would like to request accommodations or have questions, you can make an appointment by calling SDS at 215-573-9235. The office is located in the [Weingarten Learning Resources Center](#) at Stouffer Commons: 3702 Spruce Street, Suite 300. All services are confidential.

You will need:

The **textbook**: “Street-fighting Mathematics” by Sanjoy Mahajan, available as a [free download from MIT press](#). The text will be supplemented by other readings that I’ll post on Canvas.

A **computer** that:

- Has an internet connection fast enough to stream or download the video lectures
- Has a secure [web browser that is supported by Canvas](#)
- Satisfies the [system requirements for Canvas](#)

Some way to **submit your work electronically**:

- If you don’t want to type all your assignments, you can use a **smartphone camera** to scan/photograph handwritten work, either [using built-in apps](#) or [using a free third-party scanner app](#) ([broader list including paid and free options](#)). You don’t need Optical Character Recognition (OCR; converts handwriting into typed text). See these [guidelines for making a legible photo](#).
- At libraries and copy centers, **copy machines will often also scan documents** and email them to you as a PDF, which you can then submit.
- Or you can **type everything on a word processor** - [Microsoft Word now allows you to typeset equations in LaTeX](#), and [so does LibreOffice](#) (an [open source alternative](#) to Microsoft Office) and Google Docs.

Course Components

- **The first 45 minutes** of the class meeting periods will be a lecture on a new concept (as listed in the course schedule). Then we will have a 5-minute break.
- The **remainder of each class period** will sometimes be a continued lecture, and sometimes used as a **lab session** where students will work in small groups to do a longer, more involved computation. These are indicated in the course schedule; **bring your laptop** to class on those days.
- I will hold weekly **office hours**: we’ll review material covered in the prior week and take questions about lectures, labs, and homework. These will be scheduled in the first week of class.
- **Homework** will be assigned to give practice on the concepts, due at least 1 week after we cover these concepts in class. You are welcome to work together on the homework but please write up your own solutions individually. Due dates are in the course schedule (link to be added).
- **A quiz** will be given approximately every three weeks to test your independent understanding of the material. For the quizzes, you will need **pen or pencil only (no electronics of any kind)**.
- Each student will prepare a **final presentation** where they discuss an example of dimensional analysis and order-of-magnitude estimation in an area of interest. Topics will be determined midway through the semester by consultation.

Communication

- **From me to you**: check for announcements on Canvas and/or email at least once between sessions. I will also make announcements at the start of class.
- **From you to me**: [use the Canvas Inbox to contact me](#). Don’t count on my replying quickly to messages: expect a response **within 2 business days** (i.e. not on weekends). You can also always ask questions of me or the TA at office hours.

Course Schedule

The *live updated* schedule will be available as a Google Sheet.

Getting Help

This course is intended to challenge and expand your ability to solve problems using mathematical expressions, to reason using numbers, and to interpret various types of quantitative astronomical data. The approaches you will learn are new to most people who take this class, so if you run into difficulty, ***you are not alone***. You have many options for getting additional practice. Here are some resources you can turn to for help:

Office hours: asking questions and getting help on your classwork is precisely what office hours are for! We will offer at least 2 office hours per week, scheduled so that at least one is available to everyone.

Your small group partners: you'll be assigned to a group of 2-3 students for labs. We will do some activities during the first lab session for you to get to know each other a little, so you feel a bit more comfortable asking for help from each other outside those sessions. Don't hesitate to give help to other people when asked, even if you're not entirely sure of the right answer: ***the best way to learn something is to teach it!***

Math and physics help: the Math Department offers **free** [drop-in Math & Physics help](#) multiple times per week. Getting problem-solving help for this class usually falls in their areas of expertise.

General learning resources: Penn's [Weingarten Learning Resource Center](#) offers **free**: [professional instruction in study skills](#), comprehensive [services for equal access to learning](#) for students with disabilities (self-identified), and [tutoring services](#) (the Math and Physics tutors will likely be able to help you).

Mental health resources: If you broke your leg, you'd go to a doctor. If your mental health needs attention, take it just as seriously. [Penn Counseling and Psychological Services](#), the [Penn Office of the Chaplain/SPARC](#), and the [Penn Reach-A-Peer Helpline](#) offer **free** help.

Financial assistance: Penn offers [emergency and opportunity funding](#) to help students cope with unexpected or unmanageable expenses (such as a broken laptop, winter or professional clothing, application and testing fees, or medical expenses). **Any** enrolled undergraduate, graduate, or professional student is potentially eligible for this financial assistance. Students do **not** need to identify as FGLI or highly aided to apply.

Academic Integrity

Participants are expected to abide by the [Penn Code of Academic Integrity](#) in letter *and* spirit. Scientific research is a collaborative endeavor that depends on proper acknowledgment of each person's contributions to a project: this holds in this course as it does in general.

“Creating a supportive environment to enable scientific discourse ... is the responsibility of all participants.”

American Physical Society,
Code of Conduct for APS Meetings

Fostering an inclusive atmosphere in scientific discussions is an integral part of academic and professional ethics. Participants are expected to abide by the [Penn Code of Student Conduct](#) during course activities, and to use the following guidelines as a standard of behavior¹:

Expected Behavior

- Be considerate, respectful, and collaborative.
- Critique ideas rather than individuals.
- Avoid personal attacks directed toward other participants.
- Be mindful of your surroundings and of your fellow participants.
- Respect the rules and policies of our online classroom in [Canvas](#), Slack, and [Zoom](#).

Unacceptable Behavior

- Harassment, intimidation or discrimination in any form will not be tolerated.
- Physical, verbal, or online abuse of any participant will not be tolerated.
- Examples of unacceptable behavior include, but are not limited to: verbal or online comments related to gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, religion, national origin, as well as inappropriate use of nudity and/or sexual images, and threatening or stalking any participant.
- Recording or photographing another individual without their explicit permission is not allowed.

Consequences

- Anyone requested to stop unacceptable behavior is expected to comply immediately.
- The course instructor may take any action deemed necessary and appropriate, including immediate removal from a class session or the course, or referral to university disciplinary procedures.

Reporting Unacceptable Behavior

- If you are the subject of unacceptable behavior or have witnessed any such behavior, please immediately notify the instructor.
- Anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety should contact campus security at **215.573.3333**.

Any member of the Penn community can call the Penn HELP line² at any time to be connected with staff trained for mental health referrals:
215-898-HELP(4357)

Evaluation

Assignments are designed to help you confirm that you understood the material, give opportunities to practice what you learned, and offer feedback on areas for improvement.

RULE ZERO: DO NOT EMAIL ME ANYTHING IMPORTANT OUTSIDE OF THE CANVAS INBOX. IT WILL FALL INTO A BLACK HOLE AND DISAPPEAR FOREVER.

The evaluations are structured so that if you miss an exercise (homework, lab) occasionally for whatever reason, it will not significantly affect your grade, so **no late work will be accepted** (electronic submission will be inaccessible after the deadline; email submissions fall under Rule Zero). Solutions to problems will be available after the deadlines where applicable, if you haven't already looked them up online (hint: it's about the journey, not the destination).

Warmups: A single question completed in the first 5 minutes of each class period, based on topics covered in recent classes. The lowest two scores will be dropped (so you can be late twice without affecting your grade!).

¹ Adapted from the [Ecological Society of America meeting code of conduct](#).

² <https://www.publicsafety.upenn.edu/safety-initiatives/help-line-215-898-help/>

Labs: You will work in small groups to solve a problem, with help available from me. One person will submit the solution arrived at by the whole group (remember to put everyone's names on it!). The lowest of your scores on the labs will be dropped when calculating your grade (effectively this means **you can be absent from one class** if you need to be for whatever reason).

Homework: Multi-part exercises on the topics covered in class. An **electronic** copy is due approximately 1 week after the class in which it's covered (you can type up your solution, or scan a handwritten one if you think I can read it). The lowest of your homework scores will be dropped when calculating your grade.

Quizzes: The quizzes will feature problems slightly less involved than the homework but with a similar flavor. They will be given during class and are **closed-book, no electronic devices** permitted (we'll keep track of time for you). Your lowest quiz score will be dropped.

Final presentation: your grade will be determined primarily (80%) by my evaluation of your presentation for style and content (a rubric will be provided midway through the semester). The remaining 20% of your presentation grade will be based on the quality of your feedback on others' presentations.

Grading summary	
Warmups (2 dropped)	10%
Labs (lowest score dropped)	20%
Homework (lowest score dropped)	30%
Quizzes (lowest score dropped)	25%
Final Presentation	15%

Acceptance of Syllabus & Code of Conduct

Please sign, detach, and return this part at the start of the first class you attend.

I have read and understood the syllabus for PHYS 3370, Fall 2024. In all matters pertaining to this course, I agree to abide by Penn's Code of Academic Integrity and the course code of conduct, as specified in the "[Academic Integrity](#)" section of the syllabus. I accept that my participation in this course is contingent on following these policies.

Signature

Date

Printed Name

PennKey