PHYS 0088 - The Physics of Energy

Professor Patrick Gallagher
Fall Term 2025-26
Tuesdays and Thursdays 2:30pm – 3:45pm
104 Thaw Hall

Goal:

The primary goal of this course is to explore the concept of energy from the perspective of physics and to expand your understanding of energy. We all have an idea of what energy is, but in this course we will build upon your current understanding of energy by exploring how scientists understand and use the concept of energy. We will then use this scientific framework to re-examine experiences of energy in our everyday life. At the end of the course, you will reflect on how you have revised your "energy intuition" because of your expanded understanding of energy from science.

Approach:

- The course will expand your current understanding of energy by exploring the physics of energy, using in-class demonstrations and "table top" experiences of key energy concepts, and looking at examples of energy in your own environment. You will evaluate how your understanding of energy evolves over the course by comparing results from a pre and post course survey and writing a short paper reflecting on how your thinking has evolved.
- In class, we will explore various aspects of the concept of energy as it hs developed and been used by scientists. This exploration will be based on lectures, discussion, demonstrations, and hands-on, participatory "experiments". The class will focus on the concepts of energy used in physics, but you do not need to have a mastery of mathematical skills to solve physics problems. There is no textbook for this class.
- You will look for applications of these energy concepts from physics in your everyday experiences and document them via a weekly homework assignment.

Course outline

The major units or modules for the course will focus on exploring different aspects of the physics of energy. In chronological order:

- The energy of motion
- Energy of objects – solids, fluids and gases
- Heat: energy in systems with many objects
- Energy flows
- The energy of interactions – electricity & magnetism, light, chemical, nuclear
- Energy at the fastest, largest and smallest scales – relativity, cosmology, and quantum mechanics
- Practical energy – exploring energy at the scale of our planet, our economy, and our society

Grading:

Philosophy

The grading philosophy for this follows from the learning objectives and the approach outlined above. This course is "contract graded", which means that you are in control of attaining the grade you want to get from this course. There are no "high stakes" tests, and there is no final exam. The grading approach allows you to redo work (within the limits defined below) in order to achieve your grade goals. In short, you can achieve the grade you want by performing the work described below.

Overall grade:

The overall grade for the course is based on three major components, each tied to one of the learning objectives:

1. **Unit review quizzes (35% of your final grade)** to assess your understanding of new concepts of energy from physics and a basic understanding of the terminology used by scientists to describe energy.
2. **Homework assignments (35% of your final grade)**: you will document your application or description of everyday phenomena that illustrate some of the new concepts. These will account for 30% of the final grade.
3. **Self-assessment (30% of your final grade)** - you will submit an end-of-term paper reflecting on how your understanding of energy has changed during the course. This reflection will be based on a comparison of a before (start of semester) and final (end of semester) self-assessment survey.

Letter grades are determined from points using the traditional scale:

Percent of total possible points	Associated letter grade
100% to 94%	A
< 94% to 90%	A-
< 90% to 87%	B+
< 87% to 84%	B
< 84% to 80%	B-
< 80% to 77%	C+
< 77% to 74%	C
< 74% to 70%	C-
< 70% to 67%	D+
< 67% to 64%	D
< 64% to 60%	D-
Below 60	F

Unit review quizzes:

At the conclusion of each module (or unit) in the course, you will take a short, multiple-choice quiz that review some of the concepts and terminology covered in that module. Quizzes will cover the content of that module (not cumulative) and the concepts to be covered in the quiz will be clearly identified in class (there are no "gotcha" questions).

If you don't get the grade you wanted from a quiz, or if you miss a quiz, you may choose to retake it as often as you wish until you achieve the grade you wish. **To retake a quiz, you must contact me to schedule a retake.** Your new grade after a retake is calculated as follows: the new grade is 75% of your new quiz score plus 25% from your original quiz score.

For example, if you scored 50 on your first quiz and retook the quiz to earn 100, then your final recorded score & grade would be (75% of 100) + (25% of 50) = 75 + 12.5 = 87.5 or a B+. If you retake the quiz a second time and again score a 100%, then your final recorded grade would be (75% of 100) + (25% of 87.5) = 75 + 22 = 97, or an A.

Homework:

You will be documenting your understanding of these new concepts by looking for examples in your own everyday experiences that highlight a specific physics concept. Because these are your observations, there is no right or wrong answer, but they must be based on observations that you make! I will only be evaluating assignments to determine whether they are complete or incomplete and whether they were submitted on time, late, or are missing. Late assignments will receive partial credit, but not less than half credit. Incomplete or missing assignments receive no credit.

An assignment is marked "complete" means it demonstrates a good faith effort to address the objective of the assignment. It is marked "incomplete" otherwise. Good faith means that the homework is complete and describes your experience with energy. Homework assignments that are copied from external resources will be marked incomplete. You may redo and resubmit any assignment as many times as you wish to earn a "complete" designation, however all homework received after the original deadline will be marked late.

Because the homework assignments are to document your exploration of energy concepts around you, you are welcome to use a variety of formats for your assignment. Examples include: handwritten entries, audio or video recordings, or typed assignments.

There will be occasional assignments of "bonus" homework. These are optional assignments and are worth half credit of a regular homework assignment. These are an excellent way to boost your homework score or to make up points lost due to a late assignment.

Self-assessment reflection:

Developing an "intuition" about how the world you live in works is a key aspect of the scientific approach. In this course, you will use a short survey to assess your beginning and final understanding of energy. Your final assignment of the course will be to submit a short reflection essay of at least one page (or a short audio or video of 1-3 minutes) that describes how your understanding of energy evolved (or perhaps didn't!) over the duration of the course. A rubric will be provided to guide you on what types of things to include in your reflection paper to receive full credit.

Like the homework assignments, this final reflection is yours alone – there are no right or wrong answers! I will evaluate whether or not you took the surveys and if the final personal reflection paper is "complete" or "incomplete", using the same criterion in the rubric.

Attendance

Even though it is not part of your grade, attending class sessions is an important element of the course because it gives you the opportunity to explore various concepts of physics together, including by participating in demonstrations and hands-on experiments. Because of the specialized equipment used for some of the classroom based experiences, you will not generally be able to fully make up a missed class. However, class notes and presentation materials are available on the Canvas site. While I encourage you to attend every class session, I do understand that this is not always possible.

There are several special circumstances where I ask you to contact me so we can work together to minimize conflicts ahead of time and minimize any problems reaching your grade goals.

Religious Observances:

I am committed to providing equivalent educational opportunities to students of all belief systems. To assist me, at the beginning of the semester, please review the course requirements and your personal calendar to identify foreseeable conflicts with assignments, exams, or other required attendance and contact me within the first two weeks of the term to allow time for us to discuss and make fair and reasonable adjustments to the deadlines associated with the course.

Expected conflicts:

If a known schedule conflict arises which will adversely impact your ability to complete class assignments, please contact me as soon as you know, so we can explore ways to accommodate your needs and minimize the impact on your grade. Examples include athletic schedules (for student-athletes), but this applies to any foreseeable scheduling conflict that you are aware of in advance. I cannot make schedule accommodations if you have not brought them to my attention.

Unexpected conflicts:

In the case of an unexpected conflict, please contact me via email as soon as you can so we can see if there is a way to accommodate your needs. These will be on a case-by-case basis, but by working together we can minimize any adverse impact to your success.

Communication

From you to me:

I welcome communication from students in my class and I strongly encourage you to take advantage of this opportunity. There are several ways for you to contact me, depending on your needs. My office is in 217 Allen Hall and I have both unscheduled (walk in) and by-appointment office hours. These times are posted on the course Canvas site calendar, which also includes a mechanism for scheduling an appointment. I welcome in-person visits, but you can also schedule a Zoom office appointment if that is more convenient for you. If the posted times do not work for you, please send me a message so we can explore scheduling a time that meets your needs. I am generally available for scheduled meetings, even outside of my posted office hours.

The best way to send me a message is via the Canvas messaging tool. You may also use my email (pdg@pitt.edu), but because those messages are mixed with many others, there is some risk of delay and I recommend using the Canvas messaging tool because it keeps all of the course related messages in one place.

From me to you:

I will be using the Canvas Learning Management system for this course. This system has many features including class announcements, group and individual messages (an email like feature), resource and course content pages, and access to web resources, assignments and your grades. My intention is to use this system for all official communication from me regarding the course. If for any reason this will cause you problems, please contact me so we can make alternative arrangements.

Classes meeting during university or building closures

As articulated in the University-wide Closure and Class Cancellation Policy, it is the policy of the University of Pittsburgh to remain open, but in rare instances, circumstances beyond the University's control may necessitate a closure of the University or of a particular building. Such circumstances may include severe weather, power outages, water main issues, and the like.

If feasible during a campus or building closure, I intend for our class to meet **remotely** at its regularly scheduled time. On a day with an announced delay or closure for the University or for Allen Hall, please check the course Canvas site for the latest information. I will make every effort to send out a timely class announcement with updates containing additional details.

Academic Integrity

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

To learn more about Academic Integrity, visit the Academic Integrity Guide for an overview of the topic. For hands- on practice, complete the Academic Integrity Modules.

Disability Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Use of generative AI

During this class, you may elect to use Generative AI tools such as ChatGPT. This is permitted, but it is not required and is not encouraged. To adhere to scholarly practice, if you directly include any AI generated content into a submitted homework assignment, you must cite the source (a simple in-text citation is fine) to earn a "complete" for that assignment. You, and not the AI, are responsible for both the final content in the assignment, and for ensuring that it meets the criteria for a

"satisfactory" submission. Since the homework in this course focuses on your personal experiences, generative AI will not generally be helpful to you.

Statement on classroom recording

As a courtesy to everyone in the class, students may not record classroom lectures, discussion and/or activities without the advance permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use and is not to be posted online.

Protecting your rights and supporting your wellbeing

The most important element in any learning environment is the student, and nothing supports that learning environment more than ensuring that every student is treated fairly and without bias, harassment, or misconduct and to ensure that they have support they need for their health and wellbeing. In support of that goal, the University has many programs and offices to support you. I am always happy to help you find the resources that meet your needs. I have also compiled links to key resources and services offered by the University, Dietrich School of Arts and Sciences, and the Department of Physics and Astronomy on our course Canvas site on the student resources page.

Civil Rights and Title IX

The University of Pittsburgh does not tolerate any form of discrimination, harassment, or retaliation based on disability, race, color, religion, national origin, ancestry, genetic information, marital status, familial status, sex, age, sexual orientation, veteran status or gender identity or other factors as stated in the University's Title IX policy. The University is committed to taking prompt action to end a hostile environment that interferes with the University's mission. For more information about policies, procedures, and practices, visit the Civil Rights & Title IX Compliance web page.

I ask that everyone in the class strive to help ensure that other members of this class can learn in a supportive and respectful environment. If there are instances of the aforementioned issues, please contact the Title IX Coordinator, by calling 412-648-7860, or e-mailing titleixcoordinator@pitt.edu. Reports can also be filed online. You may also choose to report this to a faculty/staff member; they are required to communicate this to the University's Office of Institutional Engagement and Wellbeing. If you wish to maintain complete confidentiality, you may also contact the University Counseling Center (412-648-7930).

Sexual Misconduct, Required Reporting, and Title IX

If you are experiencing sexual assault, sexual harassment, domestic violence, and stalking, please report it to me and I will connect you to University resources to support you.

University faculty and staff members are required to report all instances of sexual misconduct, including harassment and sexual violence to the Office of Civil Rights and Title IX. When a report is made, individuals can expect to be contacted by the Title IX Office with information about support resources and options related to safety, accommodations, process, and policy. I encourage you to use the services and resources that may be most helpful to you.

As your professor, I am required to report any incidents of sexual misconduct that are directly reported to me. You can also report directly to Office of Civil Rights and Title IX: 412-648-7860 (M-F; 8:30am-5:00pm) or via the Pitt Concern Connection at: Make A Report

An important exception to the reporting requirement exists for academic work. Disclosures about sexual misconduct that are shared as a relevant part of an academic project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX office.

If you wish to make a confidential report, Pitt encourages you to reach out to these resources:

The University Counseling Center: 412-648-7930 (8:30 A.M. TO 5 P.M. M-F) and 412-648-7856 (AFTER BUSINESS HOURS)

Pittsburgh Action Against Rape (community resource): 1-866-363-7273 (24/7)

If you have an immediate safety concern, please contact the University of Pittsburgh Police, 412-624-2121

Any form of sexual harassment or violence will not be excused or tolerated at the University of Pittsburgh.

For additional information, please visit the full syllabus statement on the Office of Institutional Engagement and Wellbeing webpage.

If you are dealing with an emergency, please call the Pitt Police at 412-624-2121 or call 911.