

Physics 161 - General Physics I

Block 6, 2018-19

Professor: Niloofar Kamran

Email: nkamran@cornellcollege.edu

Office Phone: 319-895-4360

Class Location: 208 Norton Geology Building

Office: 303 Russell Science Center

Office hours: Whenever I'm in my office and M, W, Th: 3-4 pm, M, W: 11-12 or send me an email and we arrange a time

Textbook: Six Ideas that Shaped Physics, Thomas A. Moore, McGraw-Hill (2017), **Third Edition**. Units C & N.

Other supplies you will need:

- a good scientific calculator
- a pencil, or blue or black pen for quizzes and exams
- a notebook for taking class and reading notes and for working problems
- a ruler
- someday I ask you to bring your laptop to class

Schedule: You should normally plan to spend from 9-11 am and from 1-3 pm in class every day. We will spend class time discussing new material, working problems, observing physical phenomena, and taking quizzes and exams. We will cover two chapters of the textbooks almost every day. You will have reading and problem solving homework almost every day. We spend the first hour of the class going over homework assignments, the homework is due to 1 pm every day.

Course Objectives: This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, reasoning, and communication. By doing the work in this class, I expect that students will:

- Develop and demonstrate conceptual understanding of physical models of phenomena including
 - Conservation of linear momentum, angular momentum, and energy
 - Relationship between net force, acceleration, velocity, and position
 - Relationship between net torque, angular acceleration, angular speed, and angle
- Strengthen quantitative reasoning skills and computational abilities
- Learn to describe and justify the logic of important equations
- Deepen understanding of the connection between observation, measurement, and theory
- Display understanding through writing and oral presentations

Learning Physics: The best way to learn physics is to practice it by doing homework problems. In order to do the homework problems, you should complete the assigned reading (before or after class, as indicated) and come to class to discuss and practice the material in the chapter. You should not expect to come away from class with a set of notes from which to study. Instead, you should take notes on the assigned reading. In class, I will ask you to think about the ideas from the chapter. You will summarize the ideas, work short exercises, and discuss examples with your classmates. I will demonstrate problem solving techniques. Class time should strengthen your understanding of the material and prepare you for the work of doing homework problems. If you come to class and had not been doing the reading part, there is a good chance that you cannot follow the subject being discussed in the class. I teach in the class assuming all of you had done the reading part, and I will ask questions on them.

Understanding Physics: You must try to understand when different equations apply and how to use them. Memorizing equations is helpful, but not sufficient. If you can reason easily, but find memorizing challenging, work on memorizing the equations. If you can memorize easily, but find reasoning challenging, pay special attention to the reasoning skills that are needed for problem solving. Please come talk to me if you are finding the material challenging.

Keeping up with the material: The ideas in a physics class build on each other, so you must understand the material we have already covered in order to understand any new material. Therefore, it is imperative that you study every day and that you work on all of your homework problems every night. You should schedule at least 4 hours a day outside of class for studying. You should keep one sheet in your notebook with all of the equations that we have used so far, along with definitions of the variables and a description of when the equation applies. Each day after class, you should review the concepts from the day, and make notes for yourself about ideas that you want to remember.

Formula sheet: You need to keep one sheet of paper (only one side) including equations and relationship we learned in class, you can use this paper as your formula sheet at exams (It should not include any solved problems/examples or any constant numbers).

Math: Math 121 is a prerequisite for this class. I expect that you have strong algebra and trigonometry skills, and that you understand how to take derivatives and integrals. If you are uncertain of your math abilities, or you need to brush up on some skills, please take advantage of the Quantitative Reasoning Studio on the first floor of Cole Library. You may speak with Jessica Johanningmeier, Quantitative Reasoning Consultant, during the day, or a student tutor in the evenings. See <http://www.cornellcollege.edu/library/ctl/gr/> for hours. Please let me know if you need additional support.

Students with disabilities: Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see <https://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml>

Academic Honesty: Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Compass, our student handbook, under the heading "Academic Policies – Honesty in Academic Work."

Homework: Homework problems are for you to practice and learn, you have a chance to ask me question regarding them the morning of the due day. It is your responsibility to ask me questions and to check your solution with the posted solution and make sure you understood them. I encourage you to discuss the homework problems with your classmates. I won't grade the homework problems in detail, I will grade one or two problems and check if you are making meaningful efforts in solving them. If you have not worked on the problems, you won't know what questions you have. Reading a problem solution someone else has written or

watching someone else solve a problem is not the same as working on it yourself. That's like trying to learn to play a piano piece by watching someone else play! I will post solutions to the problems on Moodle after class. Homework is due at 1 pm and you will not receive any credit for if you are late. Somedays we might have a **quiz** on the homework material, it will be one problem straight from your homework problems and you can use your solutions/notes to write down the answer.

Please keep track of your homework grades, having them on hand helps you to estimate where you stand in terms of final grade.

Assignments: Each day's task (including reading and homework problems) is indicated in the schedule table at the end of this document. You need to read all parts of the book not only the parts mentioned in your homework assignments. The homework readings are for more emphasize and as a guidance for reading before the class.

Attendance policy: A critical component of this course derives from your active participation in class, I will take attendance during class. I will allow you one undocumented absence for sickness or an emergency. You must notify me of the reason for your absence by e-mail the day of the absence. Any further absences will require some documentation - a note from a health care provider, for instance. for the excused absent have the option to turn in the assignment late (the day after your absent).

Exams and Grades

Activity	30	Exam 1	100
Homework	100	Exam 2	100
Bonus	20	Exam 3	150

There will be two midterm exams and one final exam

Exam 1	Tuesday of week 2	9 am – 11 am	100 pts
Exam 2	Wednesday of week 3	9 am – 11 am	100 pts
Final Exam	Wednesday of week 4	9 am – 12 N	150 pts

Total Course Points: 480 points.

Activity points:

1. Show up on time and stay in class
2. Stay active in class (answer questions, consult your teammates)
3. Follow the cellphone policy
4. Let me know if you are going to miss a class in advance.

I do not consider your time in class active if you are distracted by your cellphone, so we need to have a **cellphone policy**: You may not use cellphone while sitting in class or working on problems, unless I ask you to look up something online. If you need to use your cellphone you need to be standing at the back of the class and return to your seat when you are done.

Bonus points: for brief written reports, up to two, on events/talks/discussions on campus or off campus which contribute to your liberal arts education. You can check with before going to an event.

Grades will be assigned approximately as follows:

A	95-100%	C+	70-75%
A-	90-95%	C	65-70%
B+	85-90%	C-	60-65%
B	80-85%	D+	55-60%
B-	75-80%	D	50-55%

15th day drop: I will sign a Drop/Add form for a 15th day drop only according to the rules laid out in the Course Catalog, which states that the instructor should agree to sign the form if and only if the student (a) has complied fully with the instructor's attendance policy, (b) has taken all the tests and turned in all the papers or projects that were due by the 15th day, and (c) has made, in the opinion of the instructor, a determined effort to learn the material, complete the work, and participate in the class.

Activities

CrashCourse, Engineering	https://bit.ly/2QsS34H
CrashCourse, History of Science	https://bit.ly/2K78v9l
The Map of Physics	https://youtu.be/ZihywtixUYo
An Animated Story of Physics	https://youtu.be/ONbXccGsud4
Why the metric system matters	https://youtu.be/7bUVjJWA6Vw
When NASA Lost a Spacecraft	https://youtu.be/urcQAKKAAI0
Apollo 15 astronaut that dropped a hammer & feather, 1971	https://youtu.be/ZkaXOxg5koQ?t=15
Newton's Principia Manuscript	https://youtu.be/eZwzE2VFctI
What the Fahrenheit?!	https://youtu.be/LgrXd0NM2y8
Celsius Didn't Invent Celsius	https://youtu.be/rjht4oAByCI
Precession	https://youtu.be/ty9QSiVC2g0
Johannes Kepler	https://youtu.be/VB3V36LpGc
Tycho Brahe	https://youtu.be/7QDvKzY4aqA

	Text Material	Homework
M Day 1	C1 C3	Review course material with textbook as a resource. Read Introduction for Students Read C1.1, C1.2: nature of science, development of physics, answer C1T1 and C1T2 Solve C1M5, C1M7, C3M3, C3M4 Read C2.1 pay attention to five principles of modern physics, answer C2T1 Read C4.1 answer C4T1, C4T2, C4T3
T Day 2	C2 C4	Review course material with textbook as a resource. Solve C2M2, C2M3, C2M5, C4M1, C4M4 Read C4.6 Read N1.1 answer N1T1 Read N1.2 pay attention to Newton's law of motion, answer N1T2, N1T3 Read C5.2
W Day 3	N1.1-2 C5	Review course material with textbook as a resource. Read examples C5.1 and C5.2 Solve C5M2, C5M3, C5M6, C5M7 Read C8.1 Learn the meanings of the words in bold. Memorize Eq. 8.1. Read C8.2 Learn the meanings of the words in bold. Memorize Eq. 8.3, and understand how the two forms are related to each other (do the algebra to get from one form to the other). Read C8.3 Learn the meanings of the words in bold. Work through the algebra required by the equal signs in equation C8.10.
Th Day 4	C8 C9	Review course material with textbook as a resource. Read examples C8.1 and C8.2 Solve C8M1, C8M3, C8M5, C8M11 Read C9.6: why the phrase "potential energy of an object" is not quite correct
F Day 5	C9 C10	Review course material with textbook as a resource. Read example C9.1 Solve C9M3, C9M4 Read example C10.1 Solve C10M3, C10M4, C10M7 Read C14.1 learn about different types of collisions Get ready for Exam 1, you can work on practice test (No solution will be posted for the practice test)
M Day 6	C14 Review	Review course material with textbook as a resource. Read examples C14.1 and C14.3 Solve C14M1, C14M2, C14M5 Get ready for Exam 1, you can work on practice test (No solution will be posted for the practice test)
T	Exam 1 Day 1–Day 6	Review course material with textbook as a resource. Read C12.1 why did it take over 150 years after "conservation of momentum" for people to accept "conservation of energy"? Read C12.2 what did the term "calories" use for prior to 1840s? What did Thompson observe that contradicted caloric definition? Describe Joule's experiment. What is relation between cal and J? Read C12.4 what's the relation between friction and thermal energy? Can we

		measure the work done by friction?
W Day 7	C12 C13	<p>Review course material with textbook as a resource.</p> <p>Read the last two paragraphs of C12.6 and see why the term “specific heat” is not the best term to describe c</p> <p>Read example C12.1, C12.2</p> <p>Solve C12M2, C12M7</p> <p>Read the last two paragraphs of C13.1, why does a fuel like hydrogen require a spark to ignite, but subsequently burns quite merrily?</p> <p>Read examples C13.1, C13.2, C13.3</p> <p>Solve C13M2, C13M4, C13M7</p> <p>Read C6.1</p> <p>Read C6.2 learn about angular position, its units and how it is related to linear speed</p> <p>Read C6.3 what is angular velocity? The relationship between speed and angular speed.</p>
Th Day 8	C11 C6	<p>Review course material with textbook as a resource.</p> <p>Solve C11M5, C11M6: (a) Assuming no friction, C11M7</p> <p>Read example C6.1 and solve exercise C6X.2</p> <p>Read examples C6.2 and C6.3</p> <p>Solve C6M6, C6M9</p> <p>Want to solve a more challenging problem? Try C6R2</p> <p>Review N1.2 Newton’s laws of motion</p> <p>Read N2.1 learn about kinematic chain</p> <p>Read N2.2 learn about different classes of forces</p> <p>Review C8 what are the potential energy functions associated with gravitational interaction and electrostatic interaction and spring?</p> <p>Review C9 what is the relationship between the potential energy function $V(r)$ and force?</p>
F Day 9	C7 N2	<p>Review course material with textbook as a resource.</p> <p>Solve C7M2, C7M6, C7M7</p> <p>Read N2.3, why there is no nice force laws for contact interactions?</p> <p>Solve exercise N2X.1</p> <p>Read examples N2.3 and N2.4</p> <p>Solve N2M3, N2M7</p> <p>Read N1.3, N1.4, N1.5 learn the formal definition of velocity and acceleration</p>
M Day 10	N4 N1.3-5 N5	<p>Review course material with textbook as a resource.</p> <p>Read N4.4 learn the steps in solving a force-from-motion problem</p> <p>Read examples N4.2, N4.4</p> <p>Solve N4M5, N4M6, N4M9</p> <p>Read examples N5.4 and N5.5</p> <p>Solve N5M8, N5M11, N5M12</p> <p>Read N6.1 learn the force notation for coupled objects, read example N6.1</p>
T	N6 N7	Get ready for the exam
W Day11	Exam 2 Day7-Day10	<p>Review course material with textbook as a resource.</p> <p>Read example N6.3 and see what happens if we don’t ignore the mass of a string</p> <p>Read N6.5 carefully pay attention to how we used this checklist in class</p> <p>Solve N6M3, N6M4, N6M11: b and c</p>

		<p>Solve exercise N7X.2</p> <p>Read N7.5</p> <p>Solve Example N7.2, N7.4 and N7.5</p> <p>Solve N7M3, N7M6, N7M8</p> <p>Read N3.1 and N3.2 and solve example N3.1</p> <p>Bring your laptops to class tomorrow</p>
Th Day 12	N3 N10	<p>Review course material with textbook as a resource.</p> <p>Solve N3M2, N3M3, N3M6</p> <p>Read N10.3 and learn what are the conditions to have a simple harmonic oscillator model</p> <p>Solve example N10.1</p> <p>Solve N10M1, N10M5, N10M8</p> <p>Read N9.1 what is the definition of a freely falling object? What are the conditions for the approximation to work well and what do these conditions mean in practice? What is the roll of drag force?</p> <p>Read N9.2 and learn how to derive the equations for a simple projectile motion</p> <p>Read N8.1 review the Newtonian model and learn about the situations that we feel fictitious forces</p> <p>Read N1.2 to review Newton's first and second laws</p>
F Day 13	N9 N8	<p>Review course material with textbook as a resource.</p> <p>Read N9.4 learn about simple projectile motion checklist</p> <p>Solve example N9.1</p> <p>Read N9.5 learn how relationship N9.17 is obtained and read about the time needed to reach terminal speed</p> <p>Solve N9M5, N9M7, N9M8</p> <p>Read N8 carefully</p> <p>Solve N8M3, N8M4, N8M9</p>
M Day 14	N11 N12	<p>Review course material with textbook as a resource.</p> <p>Solve N11M7, N11M8</p> <p>Solve N12M4, N12M5, N12M8</p> <p>Bring your laptop to the class tomorrow</p>
T	Review	Bring your exams 1 and 2 to the final.
W	Final Day1-Day14	