

PHYS 141 – Elementary General Physics I
Syllabus, Spring 2023

Instructor

Dr. Keith Foreman

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Office Hours: Monday & Wednesday: 9am to 10:30am

Tuesday & Thursday: 1pm to 3pm

or by appointment



Lecture Times and Location

We will meet each Monday, Wednesday, and Friday in Jorgensen Hall Room 136 from 3:30 pm to 4:20 pm.

First lecture: Monday, January 23rd

Last lecture: Friday, May 12th

We will NOT meet March 13th through March 17th (Spring Break).

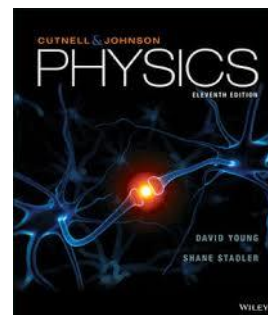
Prerequisites

MATH 102, 103, 106 or higher; or qualifying score on Math Placement Exam for MATH 106 or higher.

Text

Cutnell & Johnson, *Physics* (Wiley, 2018, 11th Edition, Volume 1, Chapters 1-17).

You don't actually need to buy a hardcopy version of the text because an electronic version of the text (eBook) is available through Canvas via *WileyPLUS*, to which you are required to subscribe. More information on *WileyPLUS* can be found below.



ACE Certification & Course Objectives

This course has been certified by the [Achievement-Centered Education](#) program at UNL to satisfy Student Learning Objective #4: “Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.”



PHYS 141 is the first of two courses in the algebra-based general physics sequence. It is a study of mechanics, heat, and waves. An understanding of algebra, simple geometry, and trigonometry are required. The main focus of this course is on the qualitative and quantitative appraisal of simple physical systems through a comprehensive process of problem solving designed to arrive at a thorough understanding of relationships between systems and their behavior. This process can be separated into four distinct phases. The first phase consists of an inquiry into what the system is and its essential components. The available data (which are given in the statement of the problem, or in diagrams, graphs, or reference tables, or some combination thereof) and the key physical principles and laws governing the system should be identified during this phase. The second phase is to interpret the physical principles and laws and the data in order to develop a plan and define goals for a solution. During this phase, the inferences that can be drawn from the data, the best way to approach the problem, the necessary mathematical relations and methods to solve the problem, and any requisite intermediate information that must be obtained should be identified. This plan is implemented in the third phase through detailed analysis, with careful attention to accurate execution of the mathematical relations representing the underlying physical principles. Critical evaluation of the reasonableness of the solutions and conclusions is the essential fourth and final phase of problem solving. This evaluation includes checking units, recalculating some quantities by a different route, and judging whether the magnitude of the answer is within reasonable physical limits.

The sections “What You Will Do” and “Exams and Grading” below explain how your ability for appraising physical situations will be developed and assessed.

The successful student will develop the critical thinking and problem-solving skills necessary for careers in the life sciences.

What You Will Do

The learning process will involve you actively in online pre-class assignments, lectures, in-class discussions, recitations, and laboratory exercises among other activities. Your responsibility is to come to lectures, recitations, and laboratory sessions ready to participate, having familiarized yourself ahead of time with the material in the textbook which is to be discussed, and to do the online pre-class assignments and assigned homework.

A few words on each activity:

ONLINE PRE-LECTURE ASSIGNMENTS - (in Canvas via *WileyPLUS*) Pre-lecture assignments are short assignments, usually free-response or multiple choice, that will generally be due on the afternoons of lecture, Monday, Wednesday, and Friday by **1pm**. A pre-lecture assignment will be posted on Canvas, with an accompanying Canvas Announcement, after each lecture and due before the subsequent lecture. These assignments help you prepare for lecture, so do these *after* you complete your reading assignment for the upcoming lecture. They also help *me* find out which topics are difficult for the group as a whole and may need more attention, which is why they are due at 1pm – this gives me enough time to review the results before class begins. These questions are also a good resource to study for the conceptual portions of exams. The pre-lecture assignments will be completed online in Canvas, often via *WileyPLUS* (more on *WileyPLUS* below).

LECTURE - Lectures will consist of presentations, demonstrations, and discussion-based problem solving. Both attendance and participation, at all lectures, are necessary to be successful in this course. Lectures are an activity and should not be wasted by passivity: listen—think—discuss—ask questions—answer questions—and be courteous. Being “courteous” means not being a distraction to other students; cell phones, in particular, should not be used during lecture other than concept question participation. During class you will participate in Peer Instruction activities using the campus “iClicker” response system (more on that topic below).

Lectures are an activity and should not be wasted by passivity: listen—think—discuss—ask questions—and answer questions. You should be actively engaged in the content by taking notes, making lists of questions to ask me during office hours, and giving serious thought to the multiple-choice concept questions (clicker questions) that will be asked during lecture. Students should take these conceptual questions seriously, as some may appear again on other for-credit work.

PEER INSTRUCTION - During lecture, you will answer conceptual questions using a device called a clicker. This is a radiofrequency remote device which is part of the “iClicker” system used in many courses at UNL. A computer in the lecture room will record and process all responses and display the result. If I notice poor understanding at this point, you will discuss the question with two or three of your classmates, after which you may revise your answer in a second voting round. This approach, called “[Peer Instruction](#)” is an evidence-based teaching pedagogy proven to greatly improve comprehension. A student that is proactive about his or her education will not waste this opportunity to improve comprehension by sitting alone and not



engaging classmates in discussion. This method also helps me learn what difficulties students are having and work them out on the spot, instead of until after an exam. Students should take these conceptual “clicker questions” seriously, as some may appear again on other for-credit work.

The iClicker Cloud smartphone app (formerly known as “REEF”) can also be used rather than a physical clicker. Be aware that the smartphone app usually requires a subscription fee. When using a physical clicker (not the app), you will need to make a free iClicker Cloud account to connect your clicker ID to the course. Your clicker ID is an eight digit/letter code found on the back of your clicker. To create or log in to your iClicker account, click [here](#). To be able to receive credit for clicker responses, you will need to input your clicker ID in your account settings in your iClicker Cloud account. When setting up your account, be sure your name appears just as it does in Canvas to ensure you receive credit.

If your phone or app malfunctions during class, inform me before leaving the lecture hall that day so I can excuse the “absence” recorded by iClicker Cloud.

RECITATION - The best way to master the physics this course will cover is to *work through* physics problems. To that end, you will attend an informal discussion section that meets once a week called a recitation. At recitation, you will learn and practice problem solving strategies in the presence of a recitation instructor that can give you immediate feedback and guidance concerning the difficulties encountered in solving problems. No new content will be delivered during recitation sessions, but rather, they will be focused on developing problem-solving skills and the problems assigned during recitation should be thought of as **practice for the exams**. The problems assigned during recitation will be graded and count toward your overall course grade. You are encouraged to ask your recitation instructors for help with any aspect of the course including the homework assignments, but they will not do your homework for you. A student that is proactive about his or her education will be actively engaged with his or her peers when working through the problems. Both group and individual problems may be assigned during recitation. You should use these problems to carefully self-assess your preparedness for exams.

ONLINE HOMEWORK - Homework is assigned on a regular basis in Canvas via *WileyPLUS*. Homework which requires turned-in, fully written out solutions on paper may also be assigned, which will be posted on Canvas. If you get stuck and need a hint, there are many resources at your disposal. You are also *always* welcome to contact me. Additionally, the [Physics Resource Center](#) is another excellent resource offering free tutoring. You may also ask your graduate teaching assistants and, especially, each other! Homework assignments will generally be due by midnight several days after lecture on the relevant content has concluded. My late policy is very simple: *Late homework will not be accepted except in extreme circumstances. Contact me as soon as possible if you believe you have reason to be granted an extended deadline.* Creative versions of “I forgot” will not be grounds for homework extensions. When a new homework assignment is available, I will always make an announcement on Canvas.

As stated above, the best way to learn physics is to do physics. While searching for the answers to your homework questions online may be tempting, a student that has not truly mastered the homework will not perform well on exams. Students that search for answers online often trick themselves into thinking they understand the physics governing the problem and perform poorly

on exams. It is easy to convince yourself you understand the physics when looking at a fully written out solution prepared by someone else. Pure memorization will not be enough to be successful in this course. Staring at a solution until you have memorized the steps is *not* the same thing as learning physics. Mastering your homework means being able to do every problem, without giving in to the temptation of looking up a solution, and truly understanding *why* each step was done the way it was done. A student that has mastered the homework will be well prepared for exams.

LABORATORY - Held in Jorgensen Hall, you will attend weekly laboratory sessions. In these laboratory sessions, you will strengthen your understanding of the physics we learn about in lecture through hands-on physics experiments. You will see, first hand, the relation between physics concepts and real-world, human-based applications. You will also develop the crucial skill of collecting and analyzing data – to form meaningful conclusions from data sets. The laboratory manual is *Humanized Physics Labs I, 2023*, and will be provided to you by your lab instructor. Each week, you will complete a pre-lab assignment in your Lab’s Canvas page to help you prepare for the coming lab, as well as wrap up any questions about the previous week’s lab.

As detailed in the lab manual, under extreme circumstances you may reschedule one lab (refer to the lab manual for instructions on how to do so). If rescheduling is not possible, fill out and submit the [Lab Excusal Request Form](#), along with supporting documents for your reason for rescheduling the lab (e.g. a doctor’s note), to the Lab Manager for approval. However, every attempt must be made to reschedule before a lab can be excused. Please note that simply filling out the form does not grant you permission to miss lab, the Lab Manager will still need to approve your request. The Lab Manager’s decision to approve or deny your request is final.

Note that perfect lab attendance is expected. Unexcused lab absences are not acceptable.

One unexcused lab absence will incur a **50% reduction of your overall lab grade.**

Two unexcused lab absences will result in a **0 for your overall lab grade.**

Three unexcused lab absences will result in a **0 for your overall course grade.**

If you have previously completed PHYS 141, having attended **all assigned labs**, and you are satisfied with your previous lab grade, you may carry your previous lab grade over to this semester. To do so, fill out the “Re-use Lab Grade Form” found in the Course Documents page on Canvas and bring it to the Lab Manager for approval. Once approved, the Lab Manager will send me your previous lab grade and that grade will be used again this semester. This form must be submitted to the Lab Manager **before the end of the first week of the semester.**

The pre-lecture assignments, multiple choice lecture questions, laboratory exercises, and homework exercises focus on specific knowledge, basic computational skills, and your grasp of key concepts. Your integrative understanding of physical principles and problem-solving is assessed with the more complex homework problems, recitation problems, and the exams.

General Statement Regarding Attendance

As you will have noticed during your course registration, this course is entirely in-person, namely the lectures, labs, recitations, and exams are all in-person. There are no online versions of recitation, lab, lecture, and exams. The [Faculty Senate Policy on Class Attendance](#) remains in effect.

Lecture Absences

If you need to miss lecture due to official University-sponsored activities such as travel as part of athletic team, or non-University-related reasons such as illness, please contact me before the absence and include the corroborating documentation (e.g. note from the athletic department, doctor's note, etc.) and I will excuse the absence. Please note contacting me well after the fact may not result in an excused absence. Note that absences due to recreational events (e.g. vacations) cannot be excused.

Recitation Absences

If you need to miss recitation due to official University-sponsored activities such as travel as part of athletic team, or non-University-related reasons such as illness, please contact your recitation TA before the absence and include the corroborating documentation (e.g. note from the athletic department, doctor's note, etc.) and your TA will excuse the absence. Please note contacting your TA well after the fact may not result in an excused absence. Note that absences due to recreational events (e.g. vacations) cannot be excused.

Laboratory Absences

Refer to the Lab Manual for official policy regarding lab absences.

As detailed in the lab manual, under extreme circumstances you may reschedule one lab (refer to the lab manual for instructions on how to do so). If rescheduling is not possible, fill out and submit the [Lab Excusal Request Form](#), along with supporting documents for your reason for rescheduling the lab (e.g. a doctor's note), to the Lab Manager for approval. However, every attempt must be made to reschedule before a lab can be excused. Please note that simply filling out the form does not grant you permission to miss lab, the Lab Manager will still need to approve your request. The Lab Manager's decision to approve or deny your request is final. Note that absences due to recreational events (e.g. vacations) cannot be excused.

General Policy Regarding Coursework Due Dates

In general, late work is not accepted. If something interferes with your course activities, a key guideline is to **communicate with me prior to the due date** of the assignment or coursework in question. I will excuse you if I decide the situation justifies doing so. In these cases I may ask from you a note, with your handwritten signature, in which you briefly state the nature of the situation (keep it general, no personal details needed), and list the missed activities that I excused you for. If you have written proof of the circumstances from another source or an official letter from, say, another UNL Department, you may also sign that document and hand it in. When submitting a Doctor's note, please keep it general, specific medical details should **not** be included. Again, please also indicate what you missed.

General Policy Regarding Course Content

I invite all of you to join me in actively creating and contributing to a positive, productive, and respectful learning environment. Each student contributes to an environment that shapes the learning process. Any work and/or communication that you are privy to as a member of this course should be treated as the intellectual property of the speaker/creator, and is not to be shared outside of the context of this course.

Students may not make or distribute screen captures, audio/video recordings of, or livestream, any class-related activity, including lectures and presentations, without express prior written consent from me or an approved accommodation from Services for Students with Disabilities (SSD). If you have accommodation to record class-related activities, you must notify me ahead of time, and those recordings may not be shared with any other student, whether in the course or not, or with any other person or on any other platform. Failure to follow this policy on recording or distributing class-related activities may subject you to discipline under the Student Code of Conduct.

Course Website & Materials



Canvas with WileyPLUS:

Our primary website for PHYS 141 will be Canvas. The PHYS 141 Canvas website is accessible through my.unl.edu. You may look up your Canvas login via [MyRED](#), UNL's student information system portal. **Be sure to check Canvas often.** Canvas will be our primary means of communication outside of lecture. I will make many Canvas Announcements throughout the semester regarding course content, due dates, exams, etc. It is your responsibility to read these announcements.

WileyPLUS is the online platform we will use for completing online assignments (pre-class quizzes, homework, etc.). It is through *WileyPLUS* that you'll also be granted access to the electronic version of our textbook and also many other unique features such as video examples, problem-solving tutorials, and demonstrations.

WileyPLUS has been integrated directly into our course's Canvas page. Meaning you will have access to all course material and assignments, including the eTextbook, through Canvas, rather than having to navigate to a third-party website. This course is part of the Bookstore's Inclusive Access program, meaning the cost of the course materials has been rolled into your tuition cost. As a result, the cost of the course materials have been discounted significantly compared to buying books and access codes from the Bookstore.

As part of the Inclusive Access program, the course materials have automatically been paired with the course Canvas page. You may be prompted to create a WileyPLUS account when first accessing course content on Canvas, but no further action will be needed on your part. **You do not need to purchase anything from the bookstore. As long as you have access to the**

course's Canvas page, you automatically have access to the course materials such as the eTextbook, homework problems, pre-lecture problems, etc.

If you choose, you can opt out of the Inclusive Access program and purchase your course materials through the bookstore. In this case, you'll need to purchase an access code for *WileyPLUS* to gain access to the assignments. However, even if you choose to opt out of Inclusive Access and purchase an access code, you will still have access to the eTextbook. Thus, **purchasing a physical copy of the book is purely optional.** Contact the bookstore if you wish to opt out of the Inclusive Access program for this course.

Click [HERE](#) to see a video on accessing *WileyPLUS* course content in Canvas via Inclusive Access or how to purchase access if you choose to opt out of the Inclusive Access program.

Normally, there will be a pre-lecture assignment due the afternoons of lecture (Mondays, Wednesdays, and Fridays) and regular homework assignments due after the relevant content has been covered in lecture. Whenever new, for-credit work is available on Canvas through *WileyPLUS*, I will always make a Canvas Announcement. Therefore, I suggest you adjust your Canvas account settings such that you receive an email whenever I make an Announcement.

WileyPLUS also has many practice assignments/questions that will be available to you. These would be purely for practice, and would not count toward your grade.

Other helpful sites:

There are also several other websites you may find useful throughout the semester. The Physics Education Technology (PhET) simulations found [here](#) are particularly useful, and we will periodically visit this website throughout the semester. The webpages of [Hypermath](#) may help you with reviewing the relevant mathematics for this course. Other recommended online resources are [Hyperphysics](#) and [Wolfram|Alpha](#). The latter, in particular, offers a wealth of information on a broad range of topics. See what happens if you enter 'iron' (omit quotes), or 'time in Australia', 'sin(3i)', 'steam', '1/4 inch bolt', or 'C major 7th chord'. This "engine" does symbolic calculation as well. Alternatively, simply enter 'sin(x)' to see variety of information on the sine function including plots, identities, derivatives, integrals, and series expansions.

Exams and Grading

Progress in the course as a whole will be assessed with five unit exams.

The dates and times for the exams are as follows:

Exam 1: Thursday, Feb. 16 th	6-7:30 pm
Exam 2: Thursday, Mar. 9 th	6-7:30 pm
Exam 3: Thursday, Apr. 6 th	6-7:30 pm
Exam 4: Thursday, Apr. 27 th	6-7:30 pm
Exam 5: Monday, May 15 th	6-8 pm (during our allotted final exam time)

Note that Exam 5 is held during the regularly scheduled final exam time determined by the Office of the Registrar. Students with SSD accommodations allowing for more time on the exam should contact me immediately. **All exams will be held in-person.**

You will need a hand-held electronic calculator during the exams. Graphing calculators are acceptable, but calculators cannot be shared amongst students during exams. Phones will not be allowed to serve as calculators and the use of a phone during exams is strictly prohibited. Using a phone during an exam will be considered cheating and will result in a score of 0 for that exam.

Make-up exams due to absences will only be granted only in the most extreme of circumstances. *If you miss an exam due to an extreme circumstance, such as serious illness, you must contact me prior to your absence. Corroborating documentation, such as a doctor's note, will be required for absences before a make-up exam will be granted. Your doctor's must clearly excuse you from classroom activities for the day of the exam.* An unexcused absence for an exam will result in a score of 0 for that exam. Grading disputes regarding exams must be brought to my attention with one week after the exams are grading and returned to students.

Alternate exams may be offered if you have a conflict with the regularly scheduled exam times due to a University-sponsored event. Corroborating documentation will be required. All alternate exams must be completed on the same day as the regularly scheduled exam. You must contact me regarding an alternate exam well in advance. Alternate exams are not offered for the final exam.

Grading. Your grade will be derived from the following course activities:

Participation/Engagement* [†]	50
Pre-Class Assignments*	50
Recitation*	100
Laboratory* [‡]	150
Homework*	150
<u>Exams 1-5 (100 pts each)</u>	<u>500</u>
Max. Total Score	1000

*Scores will be weighted out of the indicated number of points (in other words, think of these as percentages: lab is 15% of the overall grade, for example). There will not be any “dropped” assignments, recitations, labs, or exams. Extra credit cannot be offered to one student that is not also offered to the entire class.

[†]Participation and engagement means attending class, participating fully in discussions and clicker questions, and engagement in conversation with your classmates when directed. Disrupting class may result in a deduction of your participation and engagement grade. If your phone or app malfunctions during class, inform me before leaving the lecture hall that day so I can excuse the “absence” recorded by iClicker Cloud.

[‡]Perfect Laboratory attendance is expected. Please see the policies on Laboratory Attendance above.

Additional for-credit work may be assigned as well. Letter grades will be assigned after all grades are available (after the last exam, and after the recitation and lab TAs have sent me your grades), but historically, letter grades have usually been assigned as follows:

A+	98% or more
A	93 – 98%
A-	90 – 93%
B+	86 – 90%
B	82 – 86%
B-	78 – 82%
C+	74 – 78%
C	70 – 74%
C-	66 – 70%
D+	62 – 66%
D	58 – 62%
D-	54 – 58%
F	0 – 54%

Those opting for the “Pass/No Pass” option will earn a “Pass” if their letter grade would have been a C or better, and “No Pass” otherwise. An incomplete grade (I) will not be granted as a substitute for poor performance.

Note: I may deviate from the above letter grade assignments in justified cases and in response to special circumstances.

Inclement Weather Policy

If in-person classes are canceled, you will be notified of the instructional continuity plan for this course by way of a Canvas Announcement. It is your responsibility to read all Canvas Announcements. The continuity plan may include, but is not limited to, reading course materials and working on a problem on your own, or meeting via Zoom.

Honors Contracting

Honors contracts are not available for this course. Those seeking honors contracts should enroll in PHYS 141H.

Approximate Course Schedule

This course focuses on the topics of mechanics (Chapters 2-10), fluids (Chapter 11), thermodynamics (Chapters 12-15), and waves (Chapters 16-17). Roughly, we will cover about 1 chapter per week, in order, starting with Chapter 1 and omitting Chapters 8 and 13. However, rather than sticking to a rigid, inflexible schedule, we will spend more time discussing the important chapters (e.g. 4) than less important chapters (e.g. 3). Our textbook does a good job presenting physics the topics found in every general physics introductory course, however, we may skip some sections and pull some content from other sources as we make our course more relevant to the Health and Life Sciences. (I will always tell you the content covered on an exam and I will never test you on content we skip in the book.) Furthermore, I may adjust the pace as needed to find the right balance between student comprehension and quantity of covered content. Nevertheless, the pace may still seem fast for some, so it is imperative that you stay diligent with your studying to not fall behind.

UNL Course Policies and Resources

Students are responsible for knowing the university policies and resources, including policies on attendance, academic honesty, and resources for students with disabilities and mental health. These can be found at <https://go.unl.edu/coursepolicies>

Students with SSD Individual Accommodation Plans should contact me at the beginning of the semester.

Academic Dishonesty

All forms of academic dishonesty including cheating, fabrication and falsification, plagiarism, misrepresentation to avoid academic work etc. will be dealt according to the rules of [Disciplinary Procedures of the Student Code of Conduct of UNL](#).

PLEASE NOTE that the use of Chegg (or similar websites) to complete assigned work (including but not limited to homework, labs and recitations), either in whole or in part, is considered academic dishonesty. Using Chegg (or similar websites) to cheat will result in a course grade of F.

While you are encouraged to work with classmates on homework, recitation, and lab assignments, **communicating with anyone, online or in person, whether they are enrolled in the course or not, regarding exams and quizzes** is academic dishonesty.

PLEASE NOTE that I reserve the right to conduct interviews or administer oral exams in the event that I suspect a student has cheated.

FAQ

Q: If I have a question, what is the best way to contact you?

A: I try to be as available as possible to students, and hold many office hours each week, so please come to office hours! I also try to respond as quickly as possible to student email, so feel free to email through Canvas. If you have a question about a specific physics problem, it is probably best to see me during office hours, as physics can sometimes be difficult to discuss via email. It is preferable that you email me through Canvas. If you email me directly, please specify in which section you are enrolled and note that I may respond via Canvas.

Q: I could not login to a course webpage (e.g. Canvas/*WileyPLUS*), and now I lost credit. How can I avoid this?

A: Your problem is that you have waited too long. It is your own responsibility to visit course webpages on time. All material will be posted early enough to guarantee availability. Do not wait until the last moment to start assignments on Canvas/*WileyPLUS*, but rather be early (and safe).

Q: How do I prepare for the exams?

A: Master your homework and recitation problems. See the homework section above for a discussion on what is meant by this. Once you have truly understood the physics behind the homework questions (which is distinctly different than memorizing the solution), you can test yourself to see if you're prepared for an exam by selecting random problems from the end-of-

chapter problems in the text. The answers to the odd-numbered problems are in the back of the text. If you can solve these without resorting to looking up a solution online, you are prepared for the exams. Furthermore, there are many practice problems available through *WileyPLUS*. These are a great resource to use for risk-free problem solving, use them! To study for the conceptual questions on the exam, be sure you have mastered the pre-lecture questions, the clicker questions from class, and the “Check Your Understanding” concept questions from the textbook.

Q: Any tips for effective study and working on problems?

A: This course may be tough for some and easier for others, but past experience suggests that most students will fall into the former category. Into which category you fall depends a lot on your (academic) background and your willingness to work hard at mastering the content. Every student will, over time, develop a unique, personal study style. Let me give you some general advice here:

- If you really cannot solve a problem, contact me! Ask for my help anytime you feel you need it. I can always give you a useful hint.
- The text provides short answers to a large number of odd-numbered problems. I highly recommend that you do some of these extra problems – it is one of the best ways to learn physics. Trying to solve a problem that you have never seen before is the best way to test your preparedness for exams.
- Check your answers. Do you feel they could be OK? Not ridiculously large or small? Are the units OK? If you're asked to calculate a vector, do you have all three components: magnitude, direction, and unit? Carefully check each step in your reasoning. **THINK ABOUT WHAT YOU ARE THINKING:** Is your chain of reasoning correct or could you be making silent assumptions that could be false? You should be able to justify every single step you take to get your answer.
- Finally: study, study, study. Make the material your own. The embedded concept questions in the lecture videos and the textbook's “Conceptual Examples” and “Check Your Understanding” questions will be helpful for you to find out where you have breakdowns in your conceptual understanding of the material.

It is absolutely crucial that at some point during your preparation for exams, that you attempt to solve physics problems for which you have not already seen the solution. Many times, I have discussions with students that do poorly on the exams to find out that they studied by only reviewing problems for which step-by-step solutions were already available. **It is easy to convince yourself that you understand the physics of a problem when you can immediately turn to a solution, but memorizing the steps shown in an answer key is *not* the same thing as learning physics.** The *only* way to test your preparedness for an exam is by attempting to solve problems for which you do not have immediate access to the solutions. The end-of-chapter problems from the text are excellent problems to test yourself with, and the answers to the odd-numbered problems are in the back of the textbook.

Including everything (reading assignments, pre-class quizzes, lectures, recitation problems, homework, laboratory) 10 to 15 hours per week *minimum* is what many students will need to invest to earn a good grade.