Physics 151
Principles of Physics I
Fall, 2019

Meets:
Sect. 1: 8:00 am – 9:50 am
Sect. 2: 10:00 am – 11:50 am
Mon., Wed., Fri.
150 Meldrum Hall

Instructor:
Dr. Christopher Cline
278 Meldrum Hall
832-2346
ccline@westminstercollege.edu

Conditions of enrollment: A passing grade of C- or better in Math 144 (or Math 143 or Math 141/Math 142) is a prerequisite for all students enrolled in this course.

Textbook:

Required:	*College Physics: A Strategic Approach, 4th Ed.*, Randall D. Knight, et. al.
	Workshop Physics Activity Guide, Modules 1 & 2, Priscilla W. Laws
On Reserve:	*Improve Your Physics Grade*, Ronald and Robin Aaron
	Conceptual Physics, Paul G. Hewitt

Grading:
Your grade will be based on a professional judgment of your work using the following weighting scheme:

20%	Exam 1	Friday, September 27, 150 Meldrum
20%	Exam 2	Friday, November 15, 150 Meldrum
20%	Exam 3	Friday, December 13, 150 Meldrum
15%	*Written Homework*	
15%	*Activity Guide Entries*	
10%	*Course Engagement*	

Your final letter grade will be determined from percentages in the following manner:

93 to 100	A	(superior)
90 to 92.9	A –	(excellent)
87 to 89.9	B +	(extremely respectable)
83 to 86.9	B	(very respectable)
80 to 82.9	B –	(respectable)
77 to 79.9	C +	(very acceptable)
73 to 76.9	C	(acceptable)
70 to 72.9	C –	(tolerably acceptable)
67 to 69.9	D +	(passable)
63 to 66.9	D	(barely passable)
60 to 62.9	D –	(hardly passable)
0 to 59.9	F	(unacceptable)

Course Objectives and Goals:
1. Development of Transferable Scientific Skills
    a. Ability to work well in a group
    b. Research and development skills
        i. Development of conceptual understanding through observation of physical phenomena
        ii. Reasoning about physical phenomena on the basis of available evidence
        iii. Use of experimental data in the development, testing, and refinement of theoretical models
        iv. Evaluation of data sets containing extraneous information and/or noise in regard to identifying relevant/important information.
        v. Experimental design
        vi. Scientific writing ability
2. Applying course material in quantitative problem solving
3. Increased comfort in using educational technologies

How to get help: My *office hours* are MW 1:00 pm - 4:00 pm and TTh 10:00 am - 12:00 pm. If you can't come during any of these hours, I will be happy to make an appointment with you for another time. For me, *the* most enjoyable aspect of teaching is working with students one-on-one. *Please, please* come see me often—*especially* if you run into difficulties with concepts.

Philosophy, Policy, and Procedures

Physics: From the practical to the profound: Physics is ***not*** a large collection of facts or formulas to be memorized. Physics is also not the dreaming up of theories in the absence of data, or the exposé of truth, whatever that means. Physics is not mathematics; in physics, math is demoted from the wonderful art that it is to a necessary tool for dealing with quantitative predictions and data treatment. And the laws of physics do not command objects to behave in certain ways.

Physics is a science that attempts to unify elements of the natural world by means of observation, mathematics, and the use of precise language. Using methods developed by physicists, we can describe many events that occur in our everyday lives. The principles of physics provided a basis for most of the technologies that are an essential part of modern life. In this sense, physics is *practical*. Many laws developed by physicists, such as the law of conservation of energy, are of tremendous practical importance. These same laws also help physicists understand the very tiny constituents of matter as well as the motions of giant clusters of galaxies. Thus the study of physics helps us understand some fundamental relationships between the matter in our surroundings and the evolution of the universe. In this sense physics is *profound*. You are about to begin your own exploration of the natural world using some of the concepts, tools, and methods commonly employed by physical scientists. Thus, you are beginning what we hope will become a grand journey from the practical to the profound that will continue long after you have completed introductory physics.

The Workshop Physics Philosophy

I hear, I forget.
I see, I remember
I do, I understand

Anon

In traditional science courses, attending lectures, reading a textbook, and solving problems are the primary learning activities. These activities are usually supplemented by a weekly laboratory session taught by an instructor other than the lecturer. The emphasis in traditional courses is on *what* you know.

Physics 151 will be taught using the award-winning Workshop Physics method developed by Dr. Priscilla Laws of Dickinson College and used at hundreds of colleges and universities across the country. The workshop method is based upon the simple principle that understanding comes not from listening but from doing.

At its heart, physics is a science that is based upon experimentation; physics was developed through a process of observation, prediction, and refinement through further experimentation. In this course we will take a very similar approach. Instead of reading and memorizing the laws of physics from a textbook (and taking someone else's word for it that they are correct), we will seek to discover and verify them for ourselves during in-class activities. We'll use a whole host of high-tech tools such as computer driven sensors, video software, and spreadsheets to both acquire and analyze data. Abstract physics concepts will make much more sense when you can plot data instantaneously on the computer and model them using Excel. Your learning will go beyond simply memorizing physics equations; you will develop a conceptual understanding of physics as well as concrete reasoning and computer skills that will be useful in any other science course that you take. The critical question in this course is not "What do you know" but rather "*How* do you know what you know?"

Finally, let us emphasize that you are not losing anything by not being taught in the traditional lecture format - quite the contrary. Students who have completed workshop based general physics courses have been shown to perform far better than their peers who have gone through traditional courses. Workshop physics students demonstrate a far better overall understanding of physics, and, although it may seem surprising, their ability to solve traditional textbook problems is also superior. We truly believe that you will find workshop physics to be an enriching, rewarding, and, we hope, an enjoyable experience.

Before, during, and at the end of class - what's expected: An Activity Guide has been developed to support the Workshop Physics approach to learning. In-class written work will consist primarily of documenting your class activities by filling in the entries in the "activity" spaces provided. You are encouraged to keep your own notes in the margins of the Activity Guide. *You should **not** make a practice of waiting until after class to fill in your guide.*

Before coming to each class session, you should have completed the Activity Guide entries from the previous class session (hopefully in the previous class) and done the assigned reading from the text or other documents, as listed in the *course outline*. You are also strongly encouraged to have attempted to do relevant portions of the assigned *homework*.

You are expected to show up for class on time. Coming to class late is both inconsiderate and distracting to your instructor and fellow classmates. Repeatedly coming to class late will be detrimental to your class participation grade.

You are expected to show respect for others and their ideas.

During class sessions, your willingness to discuss ideas with classmates, devise clever ways to measure or observe things, and make brief presentations using the board at the front of the classroom are important aspects of your participation in the course.

You are expected to be participating actively in the class sessions at all times.

The use of the computer during scheduled class periods is restricted to course related activities. In particular, reading and sending personal e-mail, working on materials for other courses, creating personal documents, and playing computer games will be detrimental to your course engagement grade and could affect your understand of the course material.

We expect you to be careful with the lab equipment and to keep your lab table clean and neat. *At the end of every class period your table should be left with equipment arranged neatly, computer equipment off, and scrap materials thrown away*.

Written and Oral Work

***Activity Guide Entries*:** Activity Guide entries describe observations, derivations, calculations, and answers to questions. In the guide, a group of numbers signifying the unit, section, and activity number followed by the bold word **Activity:** (e.g. **5.2.2. Activity: Applying a Constant Force**) indicates that a series of entries using data, words, sketches, or graphs is requested. Although you may use the same data and graphs as your partner(s) and discuss concepts with your classmates, all entries should reflect *your own understanding* of the concepts and the meaning of the data and graphs you are presenting. *Thus each Activity Guide entry must be written in your own words. Students who copy Activity Guide entries from current or old Guides will be reported for plagiarism*. The first such occurrence will result in a score of zero on that entry; the second occurrence will result in failure of the course.

All of your Activity Guide Units will be examined for completeness. In addition, several of your Units will be chosen at random to be carefully evaluated by the instructor and given a percentage grade for quality and completeness. The instructor will look for a correct understanding of the physics involved, complete sentences, clear expository writing, proper labeling of graphs and tables, the use of appropriate units with numbers, accuracy of calculations, the expression of results to the correct number of significant figures, and adherence to instructions. *It is ultimately your responsibility to see that your entries reflect a sound understanding of the phenomena you are observing and analyzing*. Since these Activity Guide entries will be open to you when you take examinations, *it is to your advantage to create a set of entries and marginal notes based on in-class discussions and text book readings that are useful references as you complete examinations*.

All students will turn in their Activity Guide when due at the end of a unit. For each group, I will randomly choose the Activity Guide from one member of the group to grade, either for a completeness grade or for a quality grade. That grade will then be assigned as the grade for all members of that group. For example, if the members of a group are Sally, James, Meredith, and Steve, I will randomly choose and grade the Activity Guide from one of them, say Sally, and James, Meredith, and Steve will all receive the grade that Sally receives. This is to strongly encourage all members of the group to work together as a team, to help everyone be involved in and understand the activities that are being done in class, and to encourage everyone to help each other (and themselves) learn the concepts and skills at their highest level.

At the end of the semester your Activity Guide scores will be translated into a percentage grade with 70% of the grade on it determined by the quality grades given by the instructor and 30% determined by the completion scores. *Activity Guide Units are due by 5:00 p.m. two days after the Unit work is completed, or on the following Monday if the due day falls on a weekend (or an Exam day)*. For example, if a particular unit is finished in class on Monday, the Activity Guide is due by 5:00 p.m. on the following Wednesday. If a unit is finished in class on Friday, the Activity Guide is due by 5:00 p.m. on the following Monday. Late Activity Guides take teaching assistants and instructors much longer to review. In order to discourage late work, the grade on the Activity Guides will be reduced by 10% for each day or part of a day after the due date unless a written notification of illness is provided by Student Services. If an Activity Guide Unit is chosen to be quality graded, the quality grade is zero if it is handed in late.

***Homework Assignments*:** There will be a home assignment to complete for each unit; the assignments will be available from your instructor's web page. Some of the homework assignments will consist of questions based on class activities, while others are fairly difficult mathematical problems. Some of these may be adapted from problems in your textbook. Sometimes you will need to finish activities you started during class before starting the homework. At times you will need to come back to the classroom to do computer assignments. This out-of-class work will typically take 2 or more hours to complete after each class session. A typical student can expect to work about 6 to 8 hours each week out of class, and spend anywhere from 15 to 60 minutes on each homework problem.

What is the Purpose of Regular Homework?

There are two reasons why we assign homework on a regular basis. First and for most doing regular exercises right after class activities helps you clarify, retain, and extend the concepts developed during in-class activities. Our research has shown that students who do well-designed homework exercises on a regular basis learn much more physics than those who don't. The second reason for the homework assignments is to help both you and your instructors assess your progress in the course on a regular basis. For this reason we grade the homework so we can give you continuous feedback.

We have noted in the past that there is a strong correlations between the steady effort needed to successfully complete homework and performance on examinations. For example, during a recent year all of the students with exam averages above 90% had homework averages of over 85%.

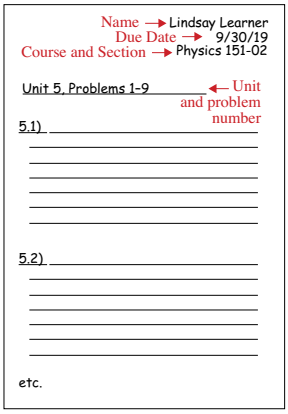
It is often difficult for beginning physics students to appreciate that the primary purpose of assigned problems in physics is *absolutely not* to see if you can get the right answer. Rather, it is for you to practice and then demonstrate that you have learned 1) how to *determine* the fundamental physical principles that are involved in a described situation and 2) how to *apply* those principles in a *disciplined* and *orderly* fashion. Of course, if you have learned how to do these things, you should expect to get the right answer too, but that is - *really* - of secondary importance. You will find - indeed, you probably *have* found - that, given time, an open book, lots of worked examples, and knowledge of the correct answer, it is very often possible to "get the answer" without the slightest understanding of what you are doing. Please guard against this; it is a *complete* waste of your time because it does not prepare you for, and it obviously will not work on, exams.

Accordingly, we are not - and *you* should not be - satisfied with problem "solutions" that simply consist of a series of mathematical manipulations leading to a result. Instead, your problem solutions should be "presented." By this we mean that they should be readable by someone who does not have access to the problem statement; should include written explanations and thoughtful comments about *what* you are doing and, especially, *why*; should use well-defined and consistent notation (employing unique and meaningful subscripts and superscripts as necessary); should be accompanied by neatly drawn and carefully labeled diagrams; and should flow in a logical and orderly progression down the page. They should use more space for the written explanatory information than for the mathematics! They should *not* include lengthy, multiple-step, purely *mathematical* manipulations because it only serves to *obscure* the physics. Do this kind of work on scratch paper and simply say something like "solving this equation for v, substituting the result into the equation for F, and simplifying we obtain..."

Handwritten Homework

Homework is due by 5:00 p.m. two days after the Unit work is completed, or on the following Monday if the due day falls on a weekend (or an Exam day). For example, if a particular unit is finished in class on Monday, the homework is due by 5:00 p.m. on the following Wednesday. If a unit is finished in class on Friday, the homework is due by 5:00 p.m. on the following Monday. Late homework takes teaching assistants and instructors much longer to grade. In order to discourage late work, *no late assignments will be accepted*. Students who have been ill should arrange with the instructor to hand in make-up assignments. ***The grader will accept no late assignments unless your instructor has signed them***.

Homework should be submitted on 8 1/2" × 11" sheets of paper headed with your name, the due date, and your section number. The number of each exercise in the assignment should be listed at the top of the page and to the left of each answer. A sample of the required format is shown below. You will lose credit if you do not follow the format.



If more than one sheet of paper is required to write up your homework then you need to **staple the pages together**. Pages that are simply held together with paper clips or corner fold-overs may come apart and pages might get lost. The graders are not responsible for lost pages if you used paper clips or folded over the page corners.

Grading of Homework

There will typically be between 5 and 10 problems for each homework assignment. The problems will be a mix of conceptual questions that will require a short essay, and mathematical problems (which will include problems where data is collected and/or analyzed using the computer). Each homework assignment will be marked as either "Satisfactory" (100 points), or "Unsatisfactory" (0 points). You will be allowed to correct and resubmit a homework marked as "Unsatisfactory" once, within 4 days after it has been first returned to you. It is the student's responsibility to make sure that they understand all the problems. Solutions to the problems for each homework assignment will be provided on the *Homework Assignments* web page. In order for an assignment to be marked "Satisfactory", each homework problem must:

- Be well organized and readable, with plenty of room for the grader to give you written feedback.
- Include diagrams or drawings of the physical situation (graphs, free-body diagram, etc.).
- Have a running narrative, with complete English sentences, describing the steps you take in solving the problem or answering the question. The narrative should show the grader that you have a clear understanding of the concepts. This will often include a description to the particular activity in the Activity Guide that relates to this question.
- Show the equations solved in symbol form before substituting in any numbers. (You'll get better and better at this, we promise, but you must practice.)
- Show the final calculation shown with the numbers substituted into the equations having the correct units and number of significant figures.
- Clearly indicate the (correct) final answer (usually with a box around it), with the correct units and number of significant figures.
- Show a check of the final result to make sure that it makes sense (*e.g.*, having a snail crawling at 25 m/s would indicate a mistake was made somewhere).

Homework will usually be graded by your instructor, but also on occasion by an upperclassman who has taken introductory physics. Your grader may occasionally make an error in judgment or a mistake. *If you think this is the case, feel free to ask the instructor to review your homework assignment*. At the end of the semester your homework scores will be translated into a percentage grade.

Non-existence of Late Homework

Homework solutions will be posted on the *Homework Assignments* web page after all homework has been submitted/resubmitted. **No late homework will be accepted under any circumstances**. In cases where you have an extended illness lasting more than three class periods *with a note from student services*, you may negotiate a due-date for your make-up homework with your instructor.

Academic Honesty

You are allowed and encouraged to work with others on your homework assignments. However, the final product that you submit for feedback must be the result of your own efforts. Therefore, **you may share ideas and strategies with others, but collaboration on the actual finished product you submit is not allowed**. Your work is expected to be the product of your own thinking, written and explained in your own words with no parts of the work copied from external sources such as books, websites, or previous solutions, and done clearly enough in your own mind that you could explain the work from start to finish if asked. As is the case for Activity Guide Entries, *any student who copies homework from another student or other source will be reported for plagiarism*. The first such occurrence will result in a score of zero on that homework; the second occurrence will result in failure of the course.

***Examinations*:** There will be **three in-class examinations** during the semester. Questions on these examinations will be based primarily on course activities and homework assignments. Emphasis will be placed on demonstration of the ability to apply the concepts and techniques learned to new situations. Material for the examinations will be drawn from the Activity Guide, assigned problems, and suggested readings as well as from class discussions and oral presentations by instructors. Unless we specify otherwise, *examinations will be open to the Activity Guide, your graded homework, and other written material and notes that **you** generated during the course*. You may also use an electronic calculator and at times you may be required to use one of the computers to perform analyses and make calculations during examinations. *Examinations will not be open to your textbook or other books, published exam or homework solutions, and other people's ideas*. You may not work with or gain assistance from anyone except your instructor.

Cheating on exams will not be tolerated. Again, the first such occurrence will result in a score of zero on that exam; the second occurrence will result in failure of the course.

Working old examinations, additional problems, and previously assigned problems, as well as reviewing assigned readings and your written Activity Guide work, is probably the best way to prepare for an examination. Each exam will have questions on (1) concepts, (2) observations or data analysis, and (3) problems. Although successful completion of

examinations will require a working knowledge of key definitions, concepts, and problem-solving techniques, *rote memorization of material will not help you to pass examinations*.

Policies

Arriving Late to Class: You are expected to show up for class on time. Coming to class late is both inconsiderate and distracting to your instructor and fellow classmates. Repeatedly coming to class late will be detrimental to your class participation grade.

***Attendance*:** If you are in the habit of skipping class occasionally, you should think carefully about taking this type of course. Absences create real difficulties, since practically all of the work done in the class requires the participation of two or more partners, and occasionally, special equipment. You can make up the work if you have a legitimate excuse for your absence. If you are permitted to make up an absence, try to get one of your lab partners to help you do the work. If that is not possible, I will do my best to help you get it done. However, under no circumstances should you copy data, graphs, or anything else if you were not in class to do the work. If there are reasons you cannot attend class, and you know about it ahead of time, please let me know before that class meeting. The nature of this class is such that you will do poorly if you skip class, because your grade depends to a great extent on what you do in class. It is not possible to skip class and "do the reading" or “get the notes” to make up for your absence.

***Cell Phones*:** You will be expected to turn off all cell phones and pagers while in class, and store them out of sight in your bag or backpack. The noise produced by cell phones and pagers, as well as the activity of emailing and text messaging, is very distracting and is a detriment to the learning environment.

Athletics: Participation in athletic events will not ordinarily be considered a legitimate excuse for missing class. Athletes who anticipate potential conflicts should see the instructor during the first week of the semester to make arrangements for making up missed classes.

Making Up Excused Absences: Any class period missed for which there is a legitimate excuse must be made up at a time arranged for in advance.

Respect for Equipment: We expect you to be careful with the lab equipment and to keep your lab table clean and neat. At the end of every class period your table should be left with equipment arranged neatly, computer equipment off, and scrap materials thrown away.

Late Work: Because it is helpful to your learning to have rapid feedback on your written work, the instructors will try to see that all work is graded as soon as possible. It is very inconsiderate to expect an instructor or student assistant to grade late work once the same work from the rest of the students has been graded. It takes 2-3 times longer to grade late work separately. For these reasons, your instructor will not accept homework assignments handed in after they are due. As far as Activity Guides are concerned: In order to discourage late work, the grade on an Activity Guide Unit will be reduced by 10% for each day or part of a day after the due date unless a written notification of illness is provided by Student Services. However, if that particular Activity Guide Unit happens to be chosen to be quality graded, the quality grade is zero if it is handed in late.

Academic Integrity: You are encouraged to discuss and debate the ideas in any of your assignments with your instructors, TA's, lab partners, and other classmates. If you work on assignments cooperatively, rather than independently, you may share ownership of spreadsheet, graph, and diagram files based on data you have taken with partners. However, *any other spreadsheet or written assignments must be expressed in your own words* and reflect your own format details. Thus, you may not copy (even with some modification) problem solutions or spreadsheet assignments, Activity Guide entries, or written material on examinations. *If there is reasonable evidence of copying, it will be construed as an act of plagiarism. The first such occurrence will result in a score of zero on that assignment; the second occurrence will result in failure of the course.*

Please make sure that you have read and fully understood Westminster's Policy on Academic Honesty (and Dishonesty) (as listed in the 2019-2020 *Westminster Academic Catalog*). My sincere desire is to act as facilitator - not an enforcer! - for your studies in physics. Accordingly, I operate on the assumption that all of our interactions are based on openness, honesty, and good faith. I expect all of us to be honest and to treat each other fairly and with respect. Because our trust in each other is absolutely *crucial* to the effectiveness of our relationship, I take an uncompromising stance, as should you, on the necessity for sanctions when it is violated.

ADA Statement: Westminster College seeks to provide equal access in higher education to academically qualified students with physical, learning, and psychiatric disabilities. If you need disability-related accommodations in this class, have emergency medical information you wish to share with me, or need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class or in my office. Disability Services authorizes disability-related academic accommodations in cooperation with the students themselves and their instructors. Students who need academic accommodations or have questions about their eligibility should contact Karen Hicks, Director of *Disability Services* & *Testing Center*, in the basement of Giovale Library (801-832-2272) or email *disabilityservices@westminstercollege.edu*.

Title IX: Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. Westminster is committed to providing a safe and non-discriminatory learning, living, and working environment to all members of the Westminster community and does not discriminate on the basis of sex. This includes on the basis of gender, gender identity, gender expression, or sexual orientation. The College's Title IX policy strictly prohibits sexual assault, sexual harassment, gender-based harassment, gender-based discrimination, sexual exploitation, interpersonal violence (dating violence, domestic violence, stalking), and retaliation for making a good faith report of prohibited conduct or participating in any proceeding under the policy. The policy and accompanying procedures are available at *www.westminstercollege.edu/titleix* and discuss prohibited conduct, resources, reporting, supportive measures, rights, investigations, and sanctions for violations of the policy.

If you want to make a report of prohibited conduct, you may contact Westminster's Title IX Coordinator, Kat Thomas, or report an incident *online*. Kat can be reached at *kthomas@westminstercollege.edu*, 801-832-2262, or in Malouf 107. You can also contact Deputy Coordinator Traci Siriprathane at *tsiriprathane@westminstercollege.edu*, 801-832-2862, or in HWAC 210. Please note that to the extent permitted by law, the College aims to protect the privacy of all parties involved in the investigation and resolution of reported violations of the Policy. However, the College has a duty to investigate and take actions in response to reports and cannot guarantee confidentiality or that an investigation will not be pursued. The *Counseling Center* is a confidential resource, and by law the counselors who work there cannot reveal confidential information to any third party unless there is an imminent threat of harm to self or others.

As a professor, I am a responsible employee and am required to report any information I obtain regarding conduct that may violate the policy to the Title IX Coordinator, so that students can receive supportive measures and referrals to resources, they are aware of their options, and the safety of the campus community can be ensured. If you begin to disclose an incident of prohibited conduct, I may interrupt you because I want to make sure that you have had the opportunity to discuss the incident with confidential resources on and off campus first. If you need supportive measures inside or outside the classroom because of an incident of prohibited conduct, please reach out to the Title IX Coordinator for assistance.

Title VI: Title VI of the Civil Rights Act of 1964 prohibits discrimination based on race, color, or national origin in any program or activity receiving federal financial assistance. In addition to these, Westminster policy prohibits discrimination or harassment based on ethnicity, age, religion, veteran status, or genetic information in any of its programs or activities. If you encounter this type of discrimination or harassment, or feel that you have been retaliated against for reporting prohibited conduct or participating in any related proceeding, you should contact the Equal Opportunity Administrator, Kat Thomas. She can be reached at *kthomas@westminstercollege.edu*, 801-832-2262, or in Malouf 107. The equal opportunity policy and procedures can be accessed from the *Student Life webpage*.

As a professor, just as with Title IX, I am a responsible employee and am required to report any information I obtain regarding discrimination or harassment to the Equal Opportunity Officer for further review.

Portions of this syllabus have been adapted from other instructors, including Dr. Priscilla Laws (Dickinson College), Dr. Karen Cummings (S. Connecticut State Univ.), Dr. John Mallinckrodt (CS-Pomona), and Dr. Robert Talbert (Grand Valley State University).