Manchester University

PHYS 111 A, Fall 2023
College Physics I
4 Credit Hours

Meeting Times and Locations

Mondays, Wednesdays, and Fridays, 1:30 – 2:20 PM, Room SCIC 202

Faculty

Name	Dr. Gregory W. Clark
Title	Professor of Physics
Office number	SCIC 112
Office hours	Mondays & Wednesdays, 3:00 – 3:50 PM in SCIC 112, or by appointment
Phone	260.982.5071 (office), 206.982.7588 (home)
Email	gwclark@manchester.edu (best way to contact me)

Welcome

I am glad that you are taking this course and look forward to helping you along in your journey to understand physics. Physics sometimes gets a bad rap as far as topics of study go. It is sometimes perceived as very difficult and somewhat dull. The truth is, in my experience, that physics can be quite difficult – some aspects more than others - but it is very learnable if one puts in the time and effort. Physics can be very intuitive at times and at other times not one bit intuitive! But it can nevertheless be fascinating. I hope to serve you well as a guide in learning both what comes easy and what is a bit more of a challenge in the small part of the world of physics that we will study. Is physics dull? Far from it! Not if you are fascinated by the world around you – applications and manifestations of physics are everywhere! And the more you learn about physics, the more you notice that this is so.

I look forward to meeting with you outside of regular class time to help with any questions you have. I have regular office hours (above), but it's very likely that these won't work for everyone. I am happy to meet at other times. Email me and we will find a time to meet that works for us both. We can even meet over *MS Teams* if that is more convenient.

The best way to contact me is through email. I will endeavor to respond within 24 hours during the week. On weekends, I will try my best to respond within 48 hours. My phone numbers are also listed above. If you call my office number and I'm not in, feel free to leave a message.

It is my intent that the spaces and times associated with this course are safe for you to feel free to express yourself, comfortably ask questions, and learn as best you can, regardless of background. I welcome diversity of all kinds: gender, sexuality, disability, age, ethnicity, socioeconomic status, race, and culture. I enjoy meeting and getting to know new people! I am always seeking ways to improve the atmosphere and effectiveness of my courses; your suggestions/feedback are encouraged and appreciated.

Course Summary

Course description from the MU Undergraduate Catalog: *Primarily for students with no high school physics background. The main topics include classical mechanics and thermal physics. Instruction is by lecture, demonstration, discussion, problem solving and laboratory experiences. Includes three lecture periods and a two-hour laboratory per week. This course is not intended for majors in the physical sciences. Course is first of a two-semester sequence although it may be taken as a stand-alone course. Prerequisite: MATH 105 or higher. Enrollment in MATH 105 may be concurrent. Fall. C-4NP.*

College Physics I is an algebra/trigonometry-based physics course. This semester we will study motion in one and two dimensions, rotational motion, energy, gravitation, oscillations, fluids, and, if time permits, waves. We will likely not spend time this semester on thermal physics as described in the Catalog. PHYS111 is a *Natural World Core* course designed for both non-science and science majors. This course will fulfill three credit hours of the *Core Ways of Knowing: Natural World* requirement for graduation. The course will also fulfill the LARC LA-ENS requirement, **if and only if** one takes a second 100- or 200- level science course in a different discipline (*e.g.*, with course prefix BIOL, CHEM, ENVS, NASC, PHYS).

The overall goal of the course is that you will become skilled in problem solving in the above areas by applying Newton's laws of motion and the law of conservation of energy. In the process you will apply your skills in algebra and trigonometry. Not only will this course provide you with a good, basic background in classical physics, but it will provide you with some of the tools you need to be successful for future coursework and on professional examinations (such as the MCAT and GRE) in the sciences.

Course requirements include regular attendance, class participation, timely completion of reading assignments, homework, & quizzes, laboratory participation, and completion of three examinations. I will assume that you are comfortable with college level algebra and familiar with basic trigonometry for this course (we will rely heavily upon their use).

Textbook and Other Required Resources

We will be using the *OpenStax* textbook **College Physics** by Urone & Hinrichs (2020 edition). This is a free, "open source" textbook. You can access the textbook at https://openstax.org/details/college-physics. There you can find on online version, a pdf version that you can download locally, a link to the OpenStax+SE mobile app (iPhone & Android), and a slew of student resources. You may purchase a hard copy online or through the Campus Store, if you prefer having an actual book (or, of course, you can just print out what you want!) but it is not required.

We will be covering many of the major topics from the first half of this text. Below is a tentative weekly schedule that we will strive to follow. Your first exposure to the material should be before we discuss it in class, so you are expected to read the appropriate reading assignment before class. To help encourage you to keep up with the readings, we will have brief quizzes after each weekly Base Group meeting in which we will, in part, process the reading assignment (for more information on quizzes and Base Groups see below). Bring questions about the material you have read to class!

One note on the text: It contains occasional links to "PHET Explorations," which are helpful interactive animations. Unfortunately, these were written in *Adobe Flash,* which is no longer supported on most browsers, so you will likely find that some of these links do not work. The PHET folks are in the process of converting these animations to HTML5 format and many of

these are available at the same website. To check, go to https://phet.colorado.edu and click on PHYSICS. On the left-hand side, select HTML5 (if it's not already selected) and then search for the Exploration with the same name as referenced in the text.
The *Canvas* Learning Management System will be an important online resource for this course. There you will find information related to all aspects of this course, including homework assignments, grades, and additional course materials.

Several *College Physics* level texts are available in the library stacks that you might find helpful to provide different perspectives on some topics. There is also a good collection of texts in the Mathematics & Physics Study Room (SCIC 113). Another resource will be the weekly Physics Study Table, which will begin after the first few weeks of classes (day/time/place to be announced).

Prerequisites

MATH 105 or higher. Enrollment in MATH 105 may be concurrent. Note that I do not assume you have studied trigonometry. We will learn and apply what trig that we need in our class meetings and assignments.

Class Meetings, Assessment and Grading

Class Meetings

The class meeting time is 1:30 - 2:20 PM, MWF in room SCIC 202. Class attendance & participation are essential and expected; they are course requirements and part of your grade. I will assume that you have read the assignments for each week. In class meetings, I will not simply regurgitate the reading material. Come prepared with questions about the material & be sure to ask when anything is unclear. Questions are *indispensable* for learning physics! We will spend a bit of time working in groups during class; please arrive at class prepared to work with others and to contribute to discussions.

You will need a scientific calculator for this course; bring one to all class & lab meetings. You may use a mobile phone for a calculator during class and lab, if you must, but **not** for quizzes and exams! I also strongly urge you to **not** use your phone or other electronic device for browsing, texting, *etc*., during class, unless asked to for a specific assignment. If you habitually spend time texting/web browsing during class, I reserve the right to consider you absent for that day's work. **Cell phone, smart watch, or computer use during quizzes or exams will result in failure of the quiz/exam.**

Please report any absences to me in a timely fashion, in advance, if possible. It is your responsibility to contact me about making up any missed class work for excused absences (*e.g.*, illness, family emergency, field trip, athletic game, *etc.*); I will not seek you out if you miss an assignment/quiz. Absences from exams will be excused only under extreme circumstances, for which you will need to seek approval from me, preferably in advance. If you miss class, I am happy to meet with you to discuss material you missed; contact me to set up a time to meet. If you are excused from a class due to academic and/or athletic commitments, please email me beforehand for each missed class; I use those emails to keep track of excused absences. If you miss class for another reason and it is considered an excused absence, please also send me an email to that I can track it.

Course Assignments and Due Dates

Homework will be assigned most class days (see below), due the following class day. We will have a quiz each Monday, after Base Group Meetings (see below), except for the Mondays after

each of our first two exams. Lab meetings will occur weekly beginning the second week of classes; there will be no labs during the weeks of fall break and Thanksgiving nor during the last week of classes. There will be three examinations including the cumulative final exam during Final Exam Week. See the Weekly Topic Schedule (below) for specific dates.

Homework
Homework will be assigned daily - usually a combination of questions and problems from the textbook. Most problems will be completed via *WebAssign* (accessed through *Canvas*). We will also often have a "written" homework assignment in the sense that you write out your solution and turn that in (such assignments will be designated with a "W" suffix). These written assignments will be submitted via *Canvas* (as a pdf file). Homework will be due by 11:59 PM on the first class meeting day after it was assigned. Late homework will **not** be accepted.

The purpose of homework is to develop your problem-solving skills for the material that we are currently discussing. Problem-solving is a skill that is acquired and honed only by lots and lots of practice. Expert problem-solvers do not wait until the last minute to begin attacking a problem! Start early while material from the class meeting is still fresh and while you have plenty of time to discuss them with your classmates and/or to ask me questions. Working together is encouraged in order to discuss, dissect, and develop the physics; but writeups that you turn in should be done individually in order to ensure that you understand the physics. Do not turn in solutions that are a copy of someone else's work, if you want credit; all students submitting identical solutions will receive zero credit. You will get the most out of problems if you work on them individually a bit before grouping up. Problem solving begins with reflective consideration of the problem. **Do not data-mine** for solutions on the internet; data mining is great way to sabotage your learning! And remember that presenting another person's work as your own is plagiarism and will be considered as cheating.

I expect all written homework to conform to the expectations outlined in the *Written Requirement Homework Checklist* (see last page of this syllabus). Please pay careful attention to these requirements! Your work must be legible if you want it graded. You will likely find it helpful to examine the homework solutions that I will post on *Canvas* to review your homework after it has been graded. Written problems and questions will be graded on a three-point basis:

3	perfect or nearly perfect
2	minor errors; missing units; non-adherence to one or more items in the Homework Requirements Checklist
1	major conceptual errors; little significant progress
0	problem solution late; obviously copied from available solutions or a classmate; handed in with essentially no progress or work relevant to the question; problem has no solution or explanation, only a final answer/number.

Quizzes
We will have brief quizzes after each weekly Base Group meeting. As mentioned above, we will have neither Base Group meetings nor quizzes on the Mondays after each of our first two exams. The quizzes will typically consist of a few elementary questions from the reading for the week as well as questions/problems from the previous week's topics of study. Your lowest quiz score will be dropped.

Laboratory
This course has an integrated laboratory that is required; you should have registered for a lab section when you registered for this course. There is no separate grade for the labs; lab grades

are part of the overall course grade (20%). If you are not enrolled in a lab section, please let me know right away and go to the Office of the Registrar to sign up for one.

Lab is an essential component of this course. Please arrive at your lab section on time! Each lab meeting will begin with an introductory lecture that will often introduce new concepts; many of these concepts will be ones on which we build later, so you will need to learn them. I will provide each student with a bound, quad-ruled lab notebook for recording your raw lab data, analysis, calculations, graphing, and conclusions. As much as possible, keep your lab notebooks in the laboratory until after the final exam. You will find the use of a spreadsheet or other software valuable for plotting lab work; any such plots should be appropriately and neatly mounted in your lab notebook using clear tape or glue stick. Networked computers are available in the College Physics labs. All final lab notebook entries must be submitted via *Canvas.* More details on College Physics lab expectations will be discussed during our first lab meeting.

Before coming to your lab each week, you must complete an online PreLab quiz. These quizzes will be posted on the *Canvas* site for this course each weekend under the module corresponding to the week of that lab [*e.g,* the PreLab quiz for Lab 01, which you will complete during the week of 4 – 8 Sept, will be posted under the *Week 2 (Module 2)* module]. <u>There will be no lab the first week of classes</u>.

You will also be required to take a *Pre/Post Concept Evaluation* for this course administered via *Canvas*. More details will be given out in class.

Exams & Grading

All grades will be recorded in *Canvas*. If you have questions or concerns about any grades, please notify me so that we can find a time to discuss your concerns.

The breakdown for your overall grade in this course is as follows:

Homework (daily) [2.5% WebAssign, 2.5% Written]	5%
Class Work/Participation (daily)	5%
Quizzes (weekly)	20%
Laboratory (weekly)	20%
Exam I, F, 29 Sep	15%
Exam II, F, 03 Nov	15%
Final Exam, T, 12 Dec, 3:30 – 5:20 pm	20%

All grading is done on a standard 10-point scale: A = 100 - 90, B = 80 - 89, C = 70 - 79, D = 60 - 69, F = 60 - 0. I do not grade on curves. We will have two exams during the term and a <u>cumulative</u> final during Final Exam Week. For each exam, you will be provided with an equation sheet with relevant equations that are not on the ***College Physics I Knowsheet*** (see below). .

PHYS 111 College Physics I - Weekly Topic Schedule

Reading assignments are from **College Physics** by Urone and Hinrichs, 2020 ed.
(TENTATIVE: subject to change as the semester rolls on!)

	Week of	Readings	Topics	Notes	Lab
1	M, 28 Aug	Ch. 1	Physical quantities, units, sig figs	Welcome!	---
2	M, 04 Sep	Ch. 2	1-D kinematics (motion)	† Camp Mack Possible!	1
3	M, 11 Sep	Ch. 2	1-D kinematics (motion)	† Camp Mack Possible!	2
4	M, 18 Sep	Ch. 3	2-D kinematics, vectors		3
5	M, 25 Sep	Ch. 3	Projectile motion, more with vectors	F, 29 Sep, Exam I	4
6	M, 02 Oct	Ch. 3, 4	More with 2-D motion, forces		5
7	M, 09 Oct	Ch. 4	Dynamics: Newton's 1st and 2nd laws		6
8	W, 18 Oct	Ch. 4	More with Newton's laws, the 3rd law	M & T Fall Break	---
9	M, 23 Oct	Ch. 5, 16	Friction, Hooke's law, oscillations		7
10	M, 30 Oct	Ch. 6	Uniform circular motion & gravitation	F, 03 Nov, Exam II	8
11	M, 06 Nov	Ch. 7	Work & energy		9
12	M, 13 Nov	Ch. 7	More with energy		10
13	M, 20 Nov		Catchup + Thanksgiving Break!!!	Yippee!! W – F Break	---
14	M, 27 Nov	Ch. 8	Momentum, impulse, & collisions		11
15	M, 04 Dec	Ch. 9, 10	Rotation, torque, & angular momentum		---
12 Dec		Final Exam	3:30–5:20 pm, All material we covered!	Whew!	

Details of which sections of the chapters that you should read can be found with the daily homework assignments on *Canvas*.
† Camp Mack Day Possible = Camp Mack Day will be on one of the following dates: 5 - 7 or 12 - 14 Sept. Actual date will be announced at 5:00 am on the day of the event. Classes between 8 am – 3 pm will be canceled. Go to Camp Mack!!

The Book of Nature is written in mathematical characters. ❧ *Galileo Galilei*

If I have seen further than others, it has been by standing on the shoulders of giants. ❧ *Isaac Newton*

Every now and then things become clear. ❧ *Jane Siberry*

One lesson, Nature, let me learn of thee. ❧ *Matthew Arnold*

Group Work

Base Groups

The ability to work well in groups is an important skill; most careers involve a significant amount of team-based work. In this course we will work in groups often. We will begin each week by meeting in **Base Groups. Base Groups** will be assigned on 04 Sept, and you will keep the same **Base Group** for the semester. Ideally, your **Base Group** that will provide you with additional support, encouragement, and assistance needed to make academic progress. **Base Groups** personalize the work required and the course learning experience. Feel free to exchange phone numbers and schedules with your **Base Group** members as you may wish to meet or chat outside of class. All members are expected to participate actively in class discussions, work to maintain effective working relationships with other participants, complete all assignments, assist classmates in completing their assignments and express their ideas. I will monitor and grade you on **Base Group** participation. Think critically; interact cordially!

To participate in your Monday **Base Group** meeting, you must have a ***Base Group Admission Ticket***. This ***Ticket*** will help you organize & digest the reading assignment and should contain answers to the following:

(A) Briefly, what are the main ideas/concepts in the reading assignment?
(B) What are four multiple choice questions regarding the most important aspects of the reading?
(C) Was anything from the ***College Physics I Knowsheet*** in the reading assignment? If so, what?
(D) What material, if any, did you not quite understand?

Base Group members who do not have a ***Base Group Admission Ticket*** will not be given credit for **Base Group** work for that day, including the Quiz. You are encouraged to include notes from the assignment that you have written up during your **Base Group Meeting** (these may be included on your ***Base Group Admission Ticket***); the use of your textbook will not be allowed.

In your **Base Group Meetings**, you should:

- ☛ Congratulate each other on survival since the last meeting & check if anyone is under any undue stress.
- ☞ Check that each **Base Group** member has a complete ***Base Group Admission Ticket***.
- ☛ Work on the **Base Group** assignment (often this will be in the form of a Base Group Worksheet). Each Monday, you will be assigned specific **Base Group** tasks using specific roles and/or procedures.

Remaining on task will be important; I would like us to get our **Base Group** work accomplished in a timely fashion so that we may work on applying your new knowledge. We may occasionally work in **Base Groups** on in-class exercises for longer periods of time. As an incentive to develop strong group relationships, **Base Group Bonus Points** will be awarded to all **Base Group** members if all members score 80% or higher on their Quiz. In addition, if all members of your **Base Group** achieve a scores of 70% or above on an exam, bonus points will be added to the exam score of each member. Additional incentives may develop as we move through the semester.

Informal Group Work

Often, we will work on questions and problems during class in pairs; please utilize the following procedure:

1. **Formulate** your own answer to the question/problem.
2. **Share** your answer with your partner.
3. **Listen** carefully to partner's answer. Change your mind only if persuaded by logic or information to do so.
4. **Create** a new answer, as a pair, that is superior to or incorporates each member's initial answer by synthesis, critical analysis, and cooperation.

Formal Group Work

We will occasionally work in the context of **Formal Groups** formed for specific tasks (*e.g.,* in lab). All members are expected to participate actively, work to maintain effective working relationships with other participants, assist classmates, express their ideas, not change their minds unless persuaded by logic or information to do so, and indicate agreement with the group's work, in writing. You will get more information on these groups as needed!

Academic Integrity

Academic dishonesty in any form is a serious offense. It is your responsibility to know what constitutes academic dishonesty. If you are not sure what constitutes plagiarism, please ask me for clarification before you turn in the assignment. Academic integrity policies can be found in The Source Handbook and are linked here: http://www.manchester.edu/syllabi_information. Academic dishonesty includes, but is not limited to, cheating on exams or quizzes; submitting another's work as your own, in whole or in part (*note that this also includes copying homework answers from the back of the textbook*); unauthorized collaboration; failing to correctly cite any sources used; and falsifying documentation including fabrication of sources. Fabrication of sources includes insufficient, inaccurate, or manufactured citations for materials that cannot be traced back to any source. Fabrication of sources is often an indication that AI was used to generate the material. All written and oral assignments must be your original work and may not be submitted concurrently with another class without specific written permission of both instructors. Using AI for some portion of an assignment may be acceptable as directed by the instructor as part of a specific assignment. However, material submitted as your own which was created using AI that is not properly cited constitutes plagiarism.

Academic dishonesty, including plagiarism, in any form will not be tolerated and will result in the forfeiture of the work involved with no opportunity to make up that work. Please note that bringing course materials of another student from a previous offering of this course to class or lab and/or copying its contents is not permitted and will be treated as plagiarism. Although you are **expected** to work together on homework and to discuss the material from this class, any work you hand in should be an expression of **your own understanding** of the material, *unless* an assignment is specifically given to a group. Copying and turning in the work of a classmate is plagiarism. Plagiarized work will receive zero credit for the assignment and will result in an academic dishonesty report being filed with the Office of Academic and Student Affairs; a repeat plagiarism offense will result in course failure.

Additional Syllabus Information

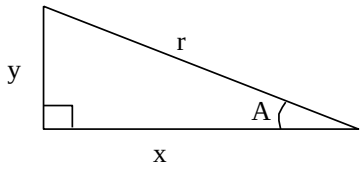
Important additional syllabus information (on academic integrity, student disability and reasonable accommodations, medical emergency/evacuation assistance, sexual misconduct reporting requirements, Spartan Success and course feedback) may be found on the Canvas course navigation bar, under "additional syllabus information" or via this link (https://www.manchester.edu/docs/default-source/academics/syllabus_information.pdf).

PHYS 111 College Physics I Knowsheet

There are some basic tools that a scientist should have at his/her disposal without having to consult a reference. This list consists of relationships that will serve you well to know. Commit these all to memory! Items 1 - 4 you should have seen in high school mathematics at some point. The Constants, and the Formulae we will encounter this semester - make sure you commit them to memory after they are introduced in a reading assignment.

1. Quadratic formula: $a\,x^2 + b\,x + c = 0$ ⇨ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

2. For right triangles:
   $\sin A = y/r$
   $\cos A = x/r$
   $\tan A = y/x$
   $x^2 + y^2 = r^2$



3. Circles: C = circumference = $2\,\pi\,r$ A = Area = $\pi\,r^2$

4. $\sin^2 A + \cos^2 A = 1$

Physical Constants: [Memorize as we encounter these in class.]

g = 9.8 m/s^2 G = 6.67 x 10^{-11} N m^2/kg^2

Physical Formulae: [Memorize as we encounter these in class; they will not be provided on exams and quizzes! I will provide all other formulae that you need for exams and quizzes.]

$$\vec{v} = \frac{\Delta \vec{r}}{\Delta t} \qquad \vec{a} = \frac{\Delta \vec{v}}{\Delta t} \qquad \vec{F}_{net} = m\vec{a} = \frac{\Delta \vec{p}}{\Delta t} \qquad \vec{w} = m\vec{g} \qquad F = -k\Delta x$$

$$F = G\frac{mM}{r^2} \qquad \omega = \frac{\Delta\theta}{\Delta t} = \frac{v}{r} \qquad \alpha = \frac{\Delta\omega}{\Delta t} \qquad a_c = \frac{v^2}{r} \qquad \vec{p} = m\vec{v}$$

$$W = F\,d\cos\theta \qquad KE = \frac{1}{2}mv^2 \qquad \Delta PE_g = mgh \qquad \Delta PE_s = \frac{1}{2}k\,\Delta s^2$$

$$f = \frac{1}{T} \qquad \omega = \frac{2\pi}{T} \qquad F_s \le \mu_s\,N \qquad F_k = \mu_k\,N$$

College Physics I - Written Homework Requirements Checklist

___ First & last name, course number, due date, & assignment number on upper right corner of each page.
___ Questions/problems clearly labeled in left margin in requested format (*i.e.*, Q 2-5, P&E 4-34).
___ Handwriting is legible and work is well-organized.
___ Appropriate variable names (see textbook) are used for all quantities (*e.g.*, *m* for mass, *v* for velocity).
___ All physical quantities should include correct units.
___ Ensure that the work you turn in is your own and not copied from a classmate or website.

For all problems, you should include ...
___ a brief summary of the problem (so you can understand it without the text).
___ a statement of the overlying principle behind the problem (starting point) & any associated equations.
___ a list of all given quantities in complete mathematical statements (including units & any conversions).
___ a reproduction of any relevant figures from the text.
___ clear, well-labeled sketches (when applicable).
___ complete and valid mathematical and algebraic statements in a logical order.
___ a clear definition of a coordinate system, if applicable.
___ plots that all have a title and appropriately labeled axes, if applicable.
___ a series of statements on how you are solving the problem (narrative).
___ any blank formulae that you are using for the solution.
___ final answer boxed or circled with a reasonable number of significant figures & appropriate units.
___ a brief reflection on your final result (Does it make sense? What does it mean?).

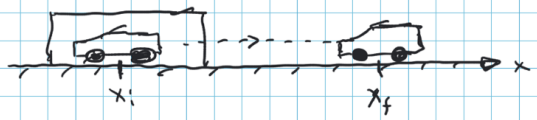
Here's an example of a problem from chapter two of the textbook with an acceptable solution that includes all relevant elements:

18. A commuter backs her car out of her garage with an acceleration of $1.40\ \mathrm{m/s^2}$. How long does it take her to reach a speed of 2.00 m/s?

GREG CLARK
PHYS 111
HW # 5
DUE: 19 SEPT

P2.18 CAR BACKS OUT OF GARAGE WITH $a = 1.40\ m/s^2$.

* IF $v_f = 2.00\ m/s$, WHAT IS Δt?



* WE'LL ASSUME $v_i = 0$ (REASONABLE FOR CAR IN GARAGE)
* THIS IS MOTION AT A CONSTANT ACCELERATION. USE KINEMATIC EQNS.
* KNOWNS: $v_i = 0$, $v_f = 2.00\ m/s$, $a = 1.40\ m/s^2$
  FIND: Δt
* USE $a = \dfrac{v_f - v_i}{\Delta t}$.

SOLVE FOR Δt: $a\,\Delta t = v_f - v_i$

$\therefore \boxed{\Delta t = \dfrac{v_f - v_i}{a} = \dfrac{2.00\ m/s - 0\ m/s}{1.40\ m/s^2} = 1.43\ s}$

* UNITS WORK OUT ✓ REASONABLE VALUE ✓