

“Is Physics 123 Right for You?”

Fall, 2016

Course Web Page: <http://www.phys.cwru.edu/courses/p123>

This document is designed to help CWRU students who have been invited to take Physics 123 decide if they should accept the invitation. Physics 123 is an “*enhanced*” version of Physics 121, the standard calculus-based introductory mechanics course. The two main enhancements are (1) a deeper application of mathematics, particularly systems described by differential equations (*although all you’ll need to know going into the course is basic integral and differential calculus*), and (2) the inclusion of a number of lectures on modern or frontier physics topics.

The invitation to enroll in PHYS 123 is based on the following criteria. Students must have taken high school physics and calculus. Additionally, students should have a solid general mathematics and verbal/English background, as demonstrated by high SAT and/or ACT scores.

Students who have a strong interest in physics and are considering majoring in Physics, Engineering Physics, and/or Mathematical Physics are encouraged to consider enrolling in PHYS 123. Students who are planning to major in physics and are especially interested in this course, but have not been invited, are encouraged to contact the course instructor and request a permit to enroll. There is, however, limited space, and we might not be able to accommodate everyone who wants to enroll in PHYS 123. Fortunately, the alternatives to PHYS 123 are also good options. For example, the PHYS 121 instructor has also taught PHYS 123 in the past and incorporates some elements of the latter in the former. All three of our introductory physics courses (Physics 115, Physics 121, and Physics 123) cover largely the same content: Classical Newtonian Mechanics.

What kind of course is Physics 123?

Physics 123 can serve as the first course in three different introductory physics sequences. Students who are considering nearly any technical major will need to take one of the following three courses:

- **Physics 115** starts a sequence that is specifically geared toward students pursuing a BA degree who are considering careers in one of the medical or health science professions. Physics 115 does not require calculus as a prerequisite and there is some extra emphasis on topics important in the life sciences, like fluid dynamics. This sequence is not normally taken by first-year students and is not accepted for most engineering and BS science degree programs, but PHYS 123 can serve as a substitute for PHYS 115.
- **Physics 121** starts the introductory calculus-based sequence and is suitable for students with a wide range of background, interests, and future plans. For Physics 121, we assume that students have taken calculus in high school and/or have credit for MATH 121 at CWRU. When we use calculus in Physics 121, we will usually take a little time to review applications of calculus. PHYS 123 can substitute for PHYS 121.
- **Physics 123** starts the “enhanced” introductory sequence. It is suitable for qualified students who are specifically interested in physics (*although not necessarily as a major*) and who are more comfortable with calculus. We will cover material on topics in modern or frontier physics that are not generally covered in the regular introductory sequence.

Below you will find the answers to some “Frequently Asked Questions”.

Where can I get more information on the details of the class including instructor contact information, syllabus, textbook, grading, etc.?

Many of these details are not finalized until late in the summer. They will appear in the fullness of time on the website <http://www.phys.cwru.edu/courses/p123>. Please check there.

What are the modern or frontier physics topics that will be covered in Physics 123?

These may be decided as we go or “on the fly,” but a recent topic was a module in chaos theory.

Is Physics 123 required to fulfill my particular major?

No, there is no requirement in any department that cannot instead be fulfilled by Physics 121 (*or, for some majors, Physics 115*).

Do I need to take Physics 123 if I am going to be a physics major?

No, potential physics majors can fully satisfy their degree requirements for introductory physics by starting with either Physics 121 or Physics 123. However, all entering students who might pursue a degree in Physics, Engineering Physics, or Mathematical Physics should consider taking Physics 123 if they have the appropriate background, since – all other things being equal – this course will give you a *stronger foundation* and a *broader vision* for all future coursework in physics. In particular, an over-arching goal of Physics 123 is to help students learn to “think like a physicist.” Therefore *any student who wants to be a physics major should consider enrolling in Physics 123, provided that the prerequisites are met.*

However, note that students who are considering a physics major but who elect to take Physics 121 instead of Physics 123 should *not* be concerned. **Historically, about half of all physics majors take Physics 121 instead of Physics 123.** Physics 121 meets all requirements and is perfectly acceptable for all physics majors.

What if I am not planning to major in physics?

As we indicated above, Physics 123 satisfies all departmental requirements for students in any science or engineering degree program, as well as pre-med requirements. Students often cite Physics 123 as one of the formative intellectual experiences during their time at Case Western. This makes Physics 123 worth considering, even if you are certain that you will never major in physics.

Is it difficult to earn a good grade in Physics 123?

As with all other courses administered by the physics department, the letter grade represents the extent to which the student has *mastered* the subject. PHYS 123 students generally succeed in meeting their personal goals with regards to letter grades.

What does it mean to say that having a high school physics class is a prerequisite?

It means that in Physics 123 we assume that you’ve had some exposure to basic topics in introductory mechanics. So if you have never taken a physics course in high school, you probably should not be enrolled in Physics 123. Most high school physics courses introduce students to concepts in kinematics (*e.g., position, velocity, acceleration*), Newton’s Laws, Conservation Laws, and so forth.

What does it mean to say that having a high school calculus class is a prerequisite?

It means that you have taken at least one calculus class in high school and know how to handle simple derivatives and integrals.

How strict is the calculus requirement? How strong do my calculus and math skills need to be?

Preparation in mathematics is typically the major issue for students trying to decide whether they are prepared for Physics 123 or not. You should read the following carefully, and if you and/or your advisor remain unsure, you should consult directly with the instructor.

Students enrolled in Physics 123 can expect to see calculus used regularly in lecture and applied liberally in homework and exams. Students who have had a strong high school calculus program that includes both differential and integral calculus should be mathematically well-prepared.

The key issue, however, is student *comfort* with the math, not just detailed prior course experience. High school

calculus programs vary greatly. Students who have either not met the formal mathematics prerequisite and/or who might feel that their high school calculus courses were not particularly strong might still be fine in Physics 123. In particular, if a student feels that he or she is a “quick study” for the application of mathematics and therefore might be able to “pick up the math as we go,” then such a student should at least consider enrolling in Physics 123, especially if he or she has a strong interest in physics.

Besides calculus, what other math skills do I need to consider taking Physics 123?

You need to be very comfortable with a full range of pre-calculus mathematics topics including trigonometry, vectors, exponents, scientific notation, and logarithms.

What if I have AP credit for physics?

Students who have taken an AP physics course in high school and/or have AP credit for introductory classical mechanics should *still* consider taking Physics 123. Even students who might otherwise place out of Physics 121 and who are eligible to enroll in Physics 122 (*electromagnetism*) might still consider enrolling in Physics 123 instead. There are several reasons to consider doing this. Even if you have placed out of Physics 121, you may feel that you could benefit from learning the material more deeply and/or more comprehensively. **Students who take Physics 123 will generally be better prepared to solve a wider range of problems than students who have simply obtained AP credit.** Students in Physics 123 will also have the exposure to extra topics that are **not** generally covered in any AP class. And finally, students who take the Physics 123 course will be better prepared to take Physics 124, the enhanced version of the introductory electromagnetism course, which will be offered in the Spring of 2016.

In short, unless you are in a big hurry to get your introductory physics requirement out of the way, you may find taking Physics 123 to be a better and more rewarding course experience than skipping straight to Physics 122.

If I take Physics 123, am I required to also take Physics 124?

No. Students who take Physics 123 and find themselves doing well are encouraged to consider Physics 124, which is the “*enhanced*” version of introductory electromagnetism. However, it is perfectly fine to take Physics 123 followed by Physics 122, which is the main calculus-based introductory electromagnetism course. Also, students who have done particularly well in Physics 121 can apply for admission to Physics 124.