

This video for Physics 131 provides an overview of the first unit on mathematical tools and fundamental concepts.

So, what is the purpose of this unit? In this unit, we will explore some of the fundamental mathematical tools and basic concepts that we will need in our study of physics, including:

- Introducing physics as a discipline, and talking about how it connects to the other sciences of chemistry and biology,
- A review of units and the policy on significant figures
- Exploring the ideas of mean and standard deviation, which we will use in the laboratory exercises of this course,
- Exploring the definitions of displacement, velocity, and acceleration and a look at how these ideas compare to the more common ideas of distance and speed,
- Using iterative methods to predict the motion of objects with non-uniform acceleration
- Exploring what a vector is and how these vectors can be added and subtracted

So, given that, what is the purpose of this homework? The purpose of this homework is to provide you with some basic information. The material in this preparation will be the starting point for what we discuss in class. This helps to make sure that everyone is starting at the same location, which is particularly important for this first unit, as I know that we have lots of different levels of prior experience amongst the students in this class. The exams will be based upon what we add to this preparation over the class sessions. So, what do I want you to focus on? I want you to focus on the definitions of the terms position, velocity, and acceleration, as well as the basic equations $V = \Delta x / \Delta t$, $\Delta x = \langle v \rangle \times \Delta t$, and $a = \Delta v / \Delta t$, including what all the symbols mean and where these equations can be applied. People often miss this underlying part, and it's important because not every equation can be applied in every situation. You need to know when certain equations can be applied and when they cannot. I also want you to learn how to turn the crank for questions like iterative calculations and vector arithmetic. I just want you to know how to do these things; don't sweat too much on exactly what it all means, as we will work on understanding what these ideas mean in class.

Before we go on, I want to have a short philosophical comment which I will couch in terms of the topic of motion with constant acceleration. If you have had physics before you may have seen these two so-called kinematic equations:

$$d = v_0 t + \frac{1}{2} a t^2 \qquad v^2 = v_0^2 + 2 a d$$

We will NOT be using these equations in this class.

We will be approaching this subject, and many others, in ways that may be different from how you may have seen them in previous physics courses. We believe that physics is not about memorizing equations but instead about ideas, and we'll teach this course from this perspective. Occasionally this perspective will result in physics homework very different from what you may expect. In particular, the unit two homework has a lot of questions which are simple vocabulary. If you try to learn physics as ideas instead of as equations, then we hope that your physics experience in this course will enrich and

enhance your understanding of your major courses, as opposed to physics simply being a course that you have to take.

Here's how to be successful on this homework and all of the other homework for the rest of this course. When you open up the homework assignment, you will see that this assignment is divided into sections. These sections are designed to help you manage your time. At the beginning of each section you have some readings. This Readings problem is only for practice and is there to help you to make sure that you complete all of the important tasks. You can open up the Readings question, and when you open it up, you will see a couple of things at the top. You will see the goals of exactly what I want you to be able to achieve from this part of the preparation. Below that, you will have a checklist, which is there to help you to make sure you complete all of the different tasks. You may have some readings in the Perusall system, or you may have some videos. The videos will be embedded directly within mastering physics and, if that embedding doesn't work, the link above the video will take you to the course YouTube page, where you can watch them there. After each reading, you also have a collection of problems. These problems are for credit; however, you do get multiple attempts. For exact details on the number of attempts and other properties, please see the syllabus. Now, the approach to each problem within a given section is detailed within the readings for that section, so if you're stuck on problems, go back to the readings, give them another look, and then try it again. The instructions of how to approach each problem should be in these readings. Moreover, within a given problem, each part of the problem (some parts have no problems) have multiple parts. Each part of the problem should be a one-step calculation, so if you find yourself doing long detailed calculations, go back and give the readings another look, as you're probably approaching it in an inefficient way.

A key aspect of completing this homework successfully is to not skip the readings or the videos. The comments that you provide in Perusall on the actual readings are graded in accordance with the policy in the syllabus, and will form part of your homework grade. While the videos are not graded, don't skip them; the reading guide videos will help you see what is important and what is less important within the readings. Moreover, some topics are not in the OpenStax textbook at all, and we've made our own videos to introduce you to these ideas. Some of the videos have step-by-step instructions on how to solve some of the homework problems. The video "Thinking about the Connection Between Average Velocity and Position" as well as the videos on simulations are good examples from this assignment. Watching these videos will give you detailed, step-by-step instructions on how to complete some of the homework problems. We acknowledge that this preparation is hard work, and we are here to help. For all of the different resources available, see the syllabus. In acknowledgement of the fact that the preparation is hard work, the preparation is the extent of the graded homework for this course, so this is what we want you to be focusing on.