HOW TO LEARN PHYSICS

Why study physics?

You shouldn't take first-year physics simply to learn facts. Do physics to develop an understanding of the underlying concepts and learn to solve problems. In physics it is essential to develop an ability to analyse problems, to reason logically, and to discriminate between important and irrelevant material. You will train your thinking through practice on simple problems, so that later on you can tackle more difficult problems. Trying to memorise physics is practically worthless!

Properly understanding the material takes work, and that takes time. Cooperative learning can be really powerful: learning physics is easier if you have a group of 'physics friends' in a study group.

Physics is the basic physical science.
It is commonly described as the science
of "how/why things work."
It's the real world!

This guide aims to point out ways to study effectively, but no one way is best for everyone. Try out the various schemes and then develop a system or study plan that is suited to you.

Visit the **Learning Physics Help Page** at:
www.physics.usyd.edu.au/learningphysics/

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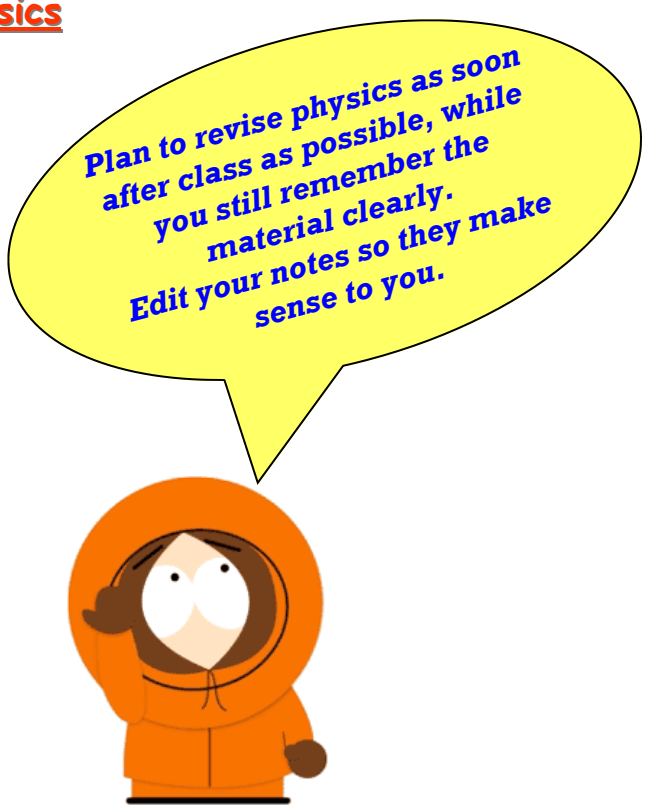
First, the way NOT to learn physics

Physics is not just solving maths problems, although this is an essential part of 'doing physics'.



Plug and chug

A common approach to 'solving' problems is to read the question, look for an equation that seems to apply, 'plug' some values into the equation and do the maths to 'chug out an answer'. You may get the 'right' answer without the brain being fully engaged, and therefore learn very little from the process.

Memorising

You may try to memorise all the patterns of sample problems, hoping that similar problems (but with different numbers) will be on the exams. Then it's just plug and chug again to grind out an answer. So, memorisation doesn't equal understanding. Some things, like equations and the values of fundamental constants, are important but they may not stick in your mind. In the 'real world' you would look them up - and in Physics we provide them in exams.

Following recipes

You need to be able to follow a set of instructions correctly and intelligently. However, if you find you can *only* solve problems by following the pattern of a worked-example problem, you obviously haven't yet grasped the basics. You should think again about the basic principles – or ask for some help. The problems on an exam will be different from the examples worked in class and in the textbook, yet the same strategies and principles will work.

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A better way to learn physics

Mainly it's a matter of focusing on the right things. You may think that the only important thing is getting the 'right' answer. Lecturers, of course, like 'right' answers, but we want you to focus on the process of using basic principles of physics to correctly analyse each physical situation.

When you achieve genuine understanding of basic principles and laws, the answers often come easily. Getting right answers with ease is a good indication that you understand the basics. Understanding needs to come first, then successfully working through problems strengthens that understanding.

So how can you achieve genuine understanding?

- Question everything, especially things that seem obvious.
- Insist on knowing where those boxed or highlighted equations come from. Experiment or Theory?
- Look for the logical and mathematical connections between equations, laws, theories and experiments. Drawing a 'Concept Map' can help.
- Don't be too easily satisfied with a correct answer. Ask yourself what that answer tells you.
- Discuss your understanding of the material with lecturers, tutors and fellow students.

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How to answer physics problems

In physics there are two common types of questions - one asks for an equation or a numerical answer, and others require an explanation of a particular physical situation. Although they may look very different, both are testing your understanding of the underlying physical concepts. You are expected to provide an explanation based on fundamental physical principles, not just a set of equations (often meaningless without an explanation) or a simple description (which only tells *what* happened, not *why*).

Some useful steps in solving problems

- ► Ask yourself "What is the question specifically asking?"
- ► State the given, implied and missing information.
- ► Draw diagrams to visualise the physical situation. They are not decoration but a tool to support and guide your thinking. A useful diagram is the centrepiece of a good explanation.
- ► Write down key concepts, principles, equations and assumptions.
- ► Often you can't see the solution immediately. So work with what you know, looking for intermediate results or ideas that will lead to a solution.
- ► For numerical questions try to do the algebra first. Don't substitute the numeric values until you have worked the problem algebraically. The algebraic solution gives you more insight than mere numbers. On the other hand, the numerical answer often gives you a good idea whether your procedure is right.
- ► Check that your answer and assumptions seem reasonable, that you have given the correct units, signs and significant figures.