

## General Tips

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### **Do not memorise**

In almost all cases, the temptation to memorise indicates a simple lack of understanding. In the words of Charles Misner: "The equation  $F = ma$  is easy to memorise, hard to use, and even more difficult to understand."

### **Keep up with the Course**

Once you fall behind it is very difficult to catch up. If you ignore this advice and do fall behind (it happens to the best of us sometimes), and if you cannot manufacture the time to do a thorough job of catching up, then skim the passed-over course material for its most important points and move on to a thorough study of the current course material. Attempting a thorough study of last week's material usually results in being one week behind for the entire semester.

### **Find a small group to work together**

Make some friends in the course and work through the material in small groups. Use these groups for discussion, problem suggestions, and companionship. Throw ideas into the group's "pot" as well as drawing ideas from it. Do not use your study group as a crutch.

### **Do the reading before attending the Lecture**

This way you won't need to take notes on everything the lecturer says, because you will already understand some of the material and you will know that some of it is treated well in your textbook. If you follow this advice, then you can use the lecture for what lecture is good at: asking questions, following the demonstrations, discovering how this week's material fits into the overall structure of the course, and gaining a conceptual understanding of the material under study. At the same time you can use the text for what text is good at: presenting derivations and sample problems, and getting the details right.

## Reading Tips

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### **Read aggressively**

Read thoughtfully and critically. Read with pencil and paper in hand, and follow any algebra or work yourself. Keep a list of questions and of points that you don't understand.

### **Take notes in my book**

Mark the most important points and record why they are important. The act of deciding what is important is the first step in turning reading from passive page-turning into active, aggres-

sive--and rewarding--penetration. (Some students take notes by highlighting with a yellow marker. This is all right, but don't fall into the trap of highlighting everything in your book!)

### **Examine the sample problems carefully**

### **If reading is too dense, skim and go over it in detail later**

If the reading is too dense, try skimming it once to get an overview of what's going on, then coming back and reading in detail the second time.

### **Reserve Aggressive Reading for more important parts of my textbook**

The active, aggressive reading advocated here is very time-consuming. Reserve it for the most important parts of your textbook. You might be able to get your teacher to list for you the most important sections, or you might have to decide for yourself.

### **Listen aggressively**

What you get out of lecture is proportional to what you put into it. If you follow the lecture, think about the material, ask questions, and care about what's going on, then lecture will be an active, productive learning experience for you.

### **Come prepared for the lectures**

Come to the lecture armed with questions for your teacher, developed from doing your reading.

### **Review the material of the lecture and make notes of important topics**

It useful to review each lecture by making a simple list of the most important topics, and also a different list of the puzzling aspects that need clarification. This review can be done through your notes or in your memory or with your study group, but it is best done soon after the lecture.

Tips on Solving Problems

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### **Do the reading and listen to the lectures before attempting the problems**

**Take a stab at the problems before the practical / conference sessions to ask well formulated questions there**

**Read the problem carefully to make sure you understand what is being asked**

**Do not rush into solving a problem. First formulate a strategy for solving the problem.**

Usually this is as simple as classifying the problem according to its method of solution. Is it a "constant acceleration" problem? A "work-energy" problem? A "Gauss's law" problem?

If you find yourself writing pages of words or working reams of algebra, then you are off on the wrong track. Stop, reread the problem, think, reformulate your strategy, and then start over again from the beginning.

**Think of the problems as mystery stories. How would Sherlock Holmes approach this problem?**

**The ability to recognise which data are needed and which are irrelevant is an important practical skill.**

Sometimes the problem statement will give you more information than is needed to answer the question. Sometimes it will give you less information than is needed, and ask you not for an answer but for a list of the unknown information required to find an answer. Sometimes the problem will be a short narrative from which you need to extract relevant information. Students often find such problems exasperating, but in fact they develop an important problem-solving skill called building a mathematical model. Problems that arise in the world outside of your textbook usually come with more or less data present than needed to solve the problem.

**Review your problem solutions when they are returned. Why did you make the mistakes you did? How could you have avoided them?**

This review should be quick (after all, you have new material piling up) but five or ten minutes spent in this review can save hours by preventing similar mistakes in the future.

Tips regarding Exams

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**Keep up with the course. Don't cram at the last minute.**

**Get a good night's sleep**

Even if you ignored the advice above and have to cram, limit cramming in favour of sleep.

**Prepare a one-page summary of the material being examined**

**Don't memorise. Your teacher expects you to work with ideas and solve problems, not plug numbers into equations.**

**Bring to the exam a calculator (fully charged) and several pens or pencils (sharpened).**

**As you read an exam problem, place a check mark beside the given data and underline the unknown quantity to be found.**

This will help you prepare a strategy and help you avoid answering a question that is similar to but different from the one that is asked.

**Make a sketch or graph to familiarise yourself with the situation. Make sure you understand the problem before plunging in.**