How to Study Physics

"How to Study Physics" by David R. Hubin and Charles Riddell, was published by the Learning Skills Center, Univ. of Texas at Austin, in 1977. This revision is by Lawrence C. Shepley, Physics Dept., Univ. of Texas, Austin, TX 78712. (He gratefully acknowledges the advice of Leslie Dickie, John Abbott College, Quebec; Kal Kallison, Learning Skills Center, UT Austin; and John Trimble, English Department, UT Austin.) Prof. Larry Shepley's email is (send him your questions and comments): larry@helmholtz.ph.utexas.edu, his homepage is at: http://wwwrel.ph.utexas.edu/Members/larry/index.html. Version of **7 October 1997**.

You, like many students, may view college level physics as difficult. You, again like many students, may seem overwhelmed by new terms and equations. You may not have had extensive experience with problem-solving and may get lost when trying to apply information from your textbook and classes to an actual physics problem. It is hoped that this pamphlet will help!

It's designed to help you stay out of the difficulties that come when you think small and get too involved in memorizing formulas or other specific details without understanding the underlying principles. It will guide you in understanding how to apply specific knowledge to the problems, how to start, how to seek help, how to check your answer. In short, it will help you develop the study skills that are important not just in physics but in all of your courses.

Contents

Getting an Overview

It's important to recognize that physics is a **problem-solving discipline**. Your physics teacher will stress major themes and principles, and one major goal is that you, the student, will be able to apply these principles to **understand and solve problems**. You should focus on this fact, that in a physics course, you are expected to solve problems.

An **overview** of your course can help you organize your efforts and increase your efficiency. To understand and retain data or formulas, you should see the underlying principles and connecting themes. It is almost inevitable that you will sometimes forget a formula, and an understanding of the underlying principle can help you generate the formula for yourself.
Take these steps to getting an overview early in the term so that all subsequent material can be integrated into your overview:

1. Examine the course outline (first day handout or syllabus) carefully, and read the official description of the course in the University Catalog. Look for underlying themes or a pattern on which the course is developed and how this course fits in with your other courses.
2. Preview the textbook:
   A. Read the introduction and table of contents.
   B. Read any notes to the student (or teacher) that are included and the preface.
   C. Check the course outline to see what chapters are assigned and which are omitted. If they are not assigned in the same order as in the table of contents, can you see a reason for your teacher's decision to alter the order of presentation?
3. As you preview the course from this perspective early in the term, look for important themes and principles. Glance at some of the problems. How are important themes illustrated in these problems?

Effective Participation in a Physics Class

It's important that you be well prepared for class in order to use its potential fully for integrating the course material. To prepare for the class, you should do the following:

Prior to each class:

1. Check the course outline or reading assignment to see what will be covered. Prepare by **briefly previewing** the

sections of the textbook that apply to the subjects to be covered. This preview will improve your ability to follow the class, for you will have seen the new terminology and will recognize signposts that will help integrate the classes into an overall picture.

2. Read the introduction and the summary of the relevant chapter and look at the section headings and subheadings. Try to formulate questions in your mind about the subjects to be covered. This question-formulating helps you manipulate and therefore better understand the material.
3. Examine the drawings and pictures. Try to determine what principles they illustrate.
4. Make notes of new words, new units of measure, statements of general laws, and other new concepts.
5. Do **not** underline or highlight the text, since you do not yet know what will be emphasized by the instructor.
6. Right before the beginning of class, check your notes from the last class. Reading your notes will prepare you to listen to the new physics class as part of an integrated course and will help you to see the broad development of themes.

During class:

Come to the class on time and stay till the very end. Often teachers give helpful hints in the first and last minutes of the lecture. Unfortunately, these times are when a lot of people are not listening.

1. **Take good notes**. It's helpful to draw up a set of **abbreviations** and use them consistently in taking notes. Keep a list of them for later reference. Leave ample margins for later comments and for questions or write on only one side so that you can use the opposite side for comments and questions (see After Class, below).
2. When you copy **drawings**, completeness is worth more than careful artwork. You should not only copy what is on the board but also record important points that the teacher makes orally about the diagram.
3. If you get behind in your note-taking, **leave a space** in your notes and go on. You can fill in your notes later with the help of a classmate or your textbook. (Note: The **Learning Skills Center** can give you additional information on note-taking.)
4. **Ask questions.** Don't be embarrassed to ask your teacher questions. Many teachers depend on feedback from students to help them set a proper pace for the class. And of course it can happen that the teacher does not explain a step he or she takes, or even makes a mistake when writing something on the board.

After class:

1. Immediately after class, or as soon as possible, **review** and edit your notes. You need not rewrite them. Rather, you should look for important ideas and relationships among major topics. Summarize these in the margin or on the opposite side if you've taken notes only on one side, and at this time you may want to add an outline to your notes. Also, this would be a good time to integrate notes from your textbook into your lecture notes; then you will have one set of integrated notes to study by.
2. As you review your notes, certain **questions** may come to mind. Leave space for recording questions, and then either ask the teacher or even better, try to answer these questions for yourself with your friends and with the help of the text.

Reading Your Physics Textbook

Reading the text and solving homework problems is a cycle: Questions lead to answers that lead back to more questions. An entire chapter will often be devoted to the consequences of a single basic principle. You should look for these basic principles. These Laws of Nature give order to the physicists' view of the universe. Moreover, nearly all of the problems that you will be faced with in a physics course can be analyzed by means of one or more of these laws.

When looking for relationships among topics, you may note that in many instances a specific problem is first analyzed in great detail. Then the setting of the problem is generalized into more abstract results. When such generalizations are made, you should refer back to the case that was previously cited and make sure that you understand how the general theory applies to the specific problem. Then see if you can think of other problems to which that general principle applies. Some suggestions for your physics reading:

1. Make use of the **preview** that you did prior to the class. Again, quickly look at the major points of the chapter. Think back to the points stressed in class and any questions you might have written down.
2. **Read the homework problems first.** If specific homework problems have not yet been assigned, select several and look these over. Critically assess what principles seem to be most significant in the assigned chapter. Based upon your brief review of the class and your examination of the problems, try to generate questions in your mind that you want the chapter to answer.
3. **Read actively** with questions in mind. A passive approach to reading physics wastes your time. Read with a pencil and paper beside the book to jot down questions and notes. If you find that you are not reading actively, once again take a look at the problems and the lecture notes. Read to learn, not to cover material.
4. **Stop** periodically and pointedly recall the material that you have read. It is a good idea to repeat material aloud and especially to add notes from the textbook into the margins of your class notes.

5. During your reading you will notice sections, equations, or ideas that apply directly to assigned problems. After you have read such a section, stop and analyze its **application** to a homework problem. The interplay of reading and problem solving is part of the cycle of question --> answer --> question. It helps you gain insights that are not possible by reading alone, even careful reading alone. Passive reading is simply following the chain of thought in the text. Active reading also involves exploring the possibilities of what is being read. By actively combining the questions that are inherent in problem solving with your reading, you enhance both your concentration while reading and your ability to recall and to apply the material.

Problem Solving in Physics

You may now be like many students a novice problem solver. The goal of this section is to help you become an expert problem solver. Effective, expert problem solving involves answering five questions:

- What's the problem about?
- What am I asked to find?
- What information am I to use? What principles apply?
- What do I know about similar situations?
- How can I go about applying the information to solve the problem?
- Does my solution make sense?

You, the expert, will decide, "this is an energy problem," or, "this is a Newton 2 problem." A novice is more likely to decide, "this is a pulley problem," or, "this is a baseball problem." The novice concentrates on the surface features of the problem while you concentrate on the underlying principle. You, an expert problem solver, will answer these questions, play around (briefly) with the problem, and make drawings and sketches (either in your mind, or even better, on paper) before writing down formulas and plugging in numbers. A novice problem solver, on the other hand, will try to write down equations and plug in numbers as soon as possible. A novice will make many more mistakes than you will when you become an expert.
In a physics course it's important to remember a couple of things about physicists and physics professors:

- A physicist seeks those problems that can be modeled or represented by a **picture or diagram**. Almost any problem you encounter in a physics course can be described with a drawing. Such a drawing often contains or suggests the solution to the problem.
- A physicist seeks to find unifying principles that can be expressed **mathematically** and that can be applied to broad classes of physical situations. Your physics text book contains many specific formulas, but you must understand the broader Laws of Nature in order to grasp the general overview of physics. This broad understanding is vital if you are to solve problems that may include several different principles and that may use several different formulas. Virtually all specific formulas in physics are combinations of basic laws.

General outline of how to approach a physics problem:

1. **Read the problem.** Look up the meanings of any terms that you do not know. Answer for yourself the question, "What's this about?" Make sure you understand what is being asked, what the question is. It is very helpful if you reexpress the problem in your own words or if you tell a friend what the problem is about.
2. Make a **drawing** of the problem. Even a poor drawing can be helpful, but for a truly good drawing include the following:
   A. Give a **title** that identifies the quantity you are seeking in the problem or that describes the problem.
   B. **Label** the drawing, including the parameters or variables on which the solution depends and that are given in the problem. Write down the given values of these parameters on the drawing.
   C. Label any **unknown** parameters that must be calculated along the way or obtained from the text in order to find the desired solution.
   D. Always give the **units of measure** for all quantities in the problem. If the drawing is a graph, be sure to give both the **units** and the **scale** of the axes.
   E. Include on the drawing information that is **assumed** and not given in the problem (such as g, the value of the acceleration due to gravity), and whether air resistance and friction are neglected.
3. Establish which **general principle** relates the given parameters to the quantity that you are seeking. Usually your picture will suggest the correct techniques and formulas. At times it may be necessary to

obtain further information from your textbook or notes before the proper formulas can be chosen. It often happens that further information is needed when the problem has a solution that must be calculated indirectly from the given information. If further information is needed or if intermediate quantities must be computed, it is here that they are often identified.

4. Draw a **second picture** that identifies the coordinate system and origin that will be used in relating the data to the equations. In some situations this second picture may be a graph, free body diagram, or vector diagram rather than a picture of a physical situation.
5. Even an expert will often use the **concrete method** of working a problem. In this method you do the calculation using the given values from the start, so that the algebra gives numerical values at each intermediate step on the way to the final solution. The **disadvantage** of this method is that because of the large number of numerical calculations involved, mistakes are likely, and so you should take special care with significant figures. However this method has the **advantage** that you can see, at every step of the way, how the problem is progressing. It also is more direct and often makes it easier to locate a mistake if you do make one.
6. As an expert, you will more and more use the **formal method** of working a problem. In this method, you calculate the solution by doing as much as possible without using specific numbers. In other words, do as much of the algebra as you can before substituting the specific given values of the data. In long and complicated problems terms may cancel or expressions simplify. Our advice: gain experience in problem solving by substituting the numbers when you start physics, but gradually adopt the formal approach as you become more confident; many people adopt a compromise approach where they substitute some values but retain others as symbols (for example, "g" for the acceleration due to gravity).
7. **Criticize your solution**: Ask yourself, "Does it make sense?" Compare your solution to any available examples or to previous problems you have done. Often you can check yourself by doing an approximate calculation. Many times a calculation error will result in an answer that is obviously wrong. Be sure to check the **units** of your solution to see that they are appropriate. This examination will develop your physical intuition about the correctness of solutions, and this intuition will be very valuable for later problems and on exams.
   An important thing to remember in working physics problems is that by **showing all of your work** you can much more easily locate and correct mistakes. You will also find it easier to read the problems when you prepare for exams if you show all your work.
8. In an **examination**, you may have to do problems under a strict time limitation. Therefore, when you are finished with a homework problem, practice doing it again faster, in order to build up your speed and your confidence.

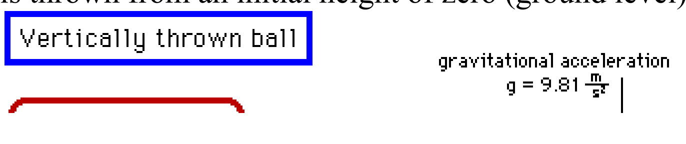
When you have completed a problem, you should be able, at some later time, to read the solution and to understand it without referring to the text. You should therefore write up the problem so as to include a **description** of what is wanted, the **principle** you have applied, and the **steps** you have taken. If, when you read your own answer to the problem, you come to a step that you do not understand, then you have either omitted a step that is necessary to the logical development of the solution, or you need to put down more extensive notes in your write-up to remind you of the reasons for each step.
It takes more time to write careful and complete solutions to homework problems. Writing down what you are doing and thinking slows you down, but more important it makes you behave more like an **expert**. You will be well paid back by the assurance that you are not overlooking essential information. These careful write-ups will provide excellent review material for exam preparation.

Examples of the Application of the Problem-Solving Principles

SAMPLE PROBLEM #1:

This problem is stated and the solution written down as you would work it out for homework.
In 1947 Bob Feller, former Cleveland pitcher, threw a baseball across the plate at 98.6 mph or 44.1 m/s. For many years this was the fastest pitch ever measured. If Bob had thrown the pitch straight up, how high would it have gone?

1. What does the problem ask for, and what is given? Answer: The speed of the baseball is given, and what is wanted is the height that the ball would reach if it were thrown straight up with the given initial speed. You should double check that whoever wrote the problem correctly calculated that 98.6 miles/hr is equal to 44.1 m/s. You should state explicitly, in words, that you will use the 44.1 m/s figure and that you will assume the baseball is thrown from an initial height of zero (ground level). You should also state explicitly what value of g you will use, for example, g =

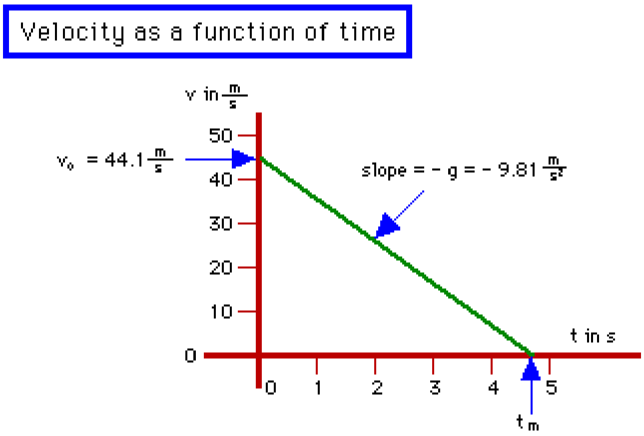


$9.81\ m/s^2$. You should also state that you assume that air resistance can be neglected. Since you don't know the mass of the baseball, say that you don't (you won't need it, anyway).

2. Make a drawing:

3. The general principles to be applied here are those of uniformly accelerated motion. In this case, the initial velocity v_o decreases linearly in time because of the gravitational acceleration. The maximum height y_m occurs at the time t_m when the velocity reaches zero. The average velocity during from $t = 0$ to $t = t_m$ is the average of the initial velocity $v = v_o$ and the final velocity $v = 0$, or half the initial velocity.

4. Make a second drawing. In this case, try a graph of velocity as a function of time:



Notice that the graph is fairly accurate: You can approximate the value of g as $10\ m/s^2$, so that the velocity decreases to zero in about 4.5 s. Therefore, even before you use your calculator, you have a good idea of about the value of t_m.

5. The concrete method can now be applied: An initial velocity of 44.1 m/s will decrease at the rate of $9.81\ m/s^2$ to zero in a time t_m given by

$$t_m = 44.1 / 9.81 = 4.4954\ s\ .$$

During that time, the average velocity is $v_{av} = 44.1 / 2 = 22.05$ m/s. Therefore the height is given by

$$y_m = v_{av}\ t_m = 99.12 = 99.1\ m\ .$$

Notice that for all "internal" calculations, more than the correct number of significant figures were kept; only when the final answer was obtained was it put into the correct number of significant figures, in this case three.

6. To do this problem in a formal method, use the formula for distance y as a function of t if the acceleration a is constant. Do not substitute numbers, but work only with symbols until the very end:

$$y = y_o + v_o\, t + a\, t^2 / 2\ ,$$

where $y_o = 0$ is the initial position, $v_o = 44.1$ m/s is the initial velocity, and $a = - g = - 9.81\ m/s^2$ is the constant acceleration. However, do not use the numerical figures at this point in the calculation. The maximum value of y is when its derivative is zero; the time t_m of zero derivative is given by:

$$dy/dt = v^o + a\, t_m = 0 \dashrightarrow t_m = - v_o / a\ .$$

The maximum height y_m is given by putting this value of t_m into the equation for y:

$$y_m = y_o + v_o (- v_o / a) + a (- v_o / a)^2 / 2 = y_o - v_o^2 / 2a\ .$$

Now substitute: $y_o = 0$, $v_o = 44.1$, $a = - 9.81$. The result is

$$y_m = 0 + 0.5\ (44.1)^2 / 9.81 = 99.1\ m\ .$$

7. Look over this problem and ask yourself if the answer makes sense. After all, throwing a ball almost 100 m in the air is basically impossible in practice, but Bob Feller did have a very fast fast ball pitch! There is another matter: If this same problem had been given in a chapter dealing with conservation of energy, you should not solve it as outlined above. Instead, you should calculate what the initial and final kinetic energy KE and potential energy PE are in order to find the total energy. Here, the initial PE is zero, and the initial KE is $m\, v_o^2 / 2$. The final PE is $m\, g\, y_m$ and the final KE is zero. Equate the initial KE to the final PE to see that the unknown mass m cancels from both sides of the equation. You can then solve for y_m, and of course you will get the same answer as before but in a more sophisticated manner.

8. To prepare for an exam, look over this problem and ask yourself how you can solve it as quickly as possible. You may be more comfortable with the concrete approach or with the formal approach; practice will tell. On an actual exam, you might not have time for a complete drawing or a complete listing of principles. By working this problem a couple of times, even after you've gotten the answer once, you will become very familiar with it. Even better, explain the problem to a friend of yours, and that way you really will be an expert!

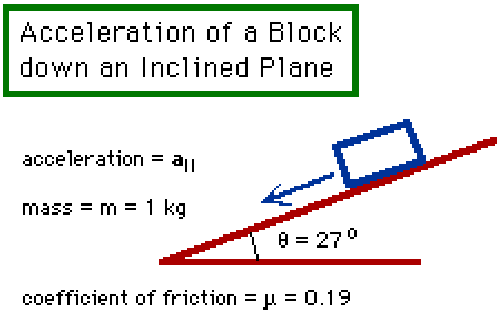
SAMPLE PROBLEM #2:

Again, this problem is stated and the solution written down as you would work it out for homework. As in Sample Problem #1, we go through the eight steps of the general outline.

A one kilogram block rests on a plane inclined at 27^o to the horizontal. The coefficient of friction between the block and the plane is 0.19. Find the acceleration of the block down the plane.

1. The problem asks for the acceleration, not the position of the block nor how long it takes to go down the plane nor anything else. No mention is made of the difference between static or kinetic coefficients of friction, so assume they are the same. The mass is given, but you will eventually find that it doesn't matter what the mass is. (If the mass had not been given, that would be an indication that it doesn't matter, but even in that case you may find it easier to assume a value for the mass in order to guide your thoughts as you do the problem.)

2. Here is the first picture. Note that the angle is labeled (θ) , and the coefficient of friction is labeled (μ) . In addition, the use of m for the mass and $\mathbf{a}_{||}$ for the acceleration down the plane are defined in the picture.



3. There are two general principles that apply here. The first is Newton's Second Law:
   F = m **a** ,
   where **F** is the net force, a vector, and **a** is acceleration, another vector; the two vectors are in the same direction. The mass m will eventually be found not to make any difference, and in that case, you might be tempted to write this law as **a** = **F** / m, since **a** is what you want to find. However, the easiest way to remember Newton's Second Law is **F** = m **a**, and so that is the law to work with.
   The second principle is that the frictional force is proportional to the normal force (the component of the force on the block due to the plane that is perpendicular to the plane). The frictional force is along the plane and always opposes the motion. Since the block is initially at rest but will accelerate down the plane, the frictional force will be up along the plane. The coefficient of friction, which is used in this proportionality relation, is .
4. It is now time to draw the second picture. It helps to redraw the first picture and add information to it. In this case a vector diagram is drawn and various forces are defined.

   Note that in the vector diagram, the block has been replaced by a dot at the center of the vectors. The relevant forces are drawn in (all except the net force). Even the value assumed for the gravitational acceleration has been included. Some effort has been made to draw them to scale: The normal force is drawn equal in magnitude and opposite in direction to the component of the gravity force that is perpendicular to the plane. Also, the friction force has been drawn in parallel to the plane and opposing the motion; it has been drawn in smaller than the normal force. The angles of the normal and parallel forces have been carefully drawn in relation to the inclined plane. This sub-drawing has a title and labels, as all drawings should.

5. We will do this problem using the formal approach, leaving the concrete method for a check (see below).
6. Now for calculation using the formal approach, where you work with algebra and symbols rather than with numbers. First state in words what you are doing, and then write down the equation:
   A. Magnitude of gravity force = weight = m g.

   B.

Call $\mathbf{F_G}$ the force of gravity (down) and $\mathbf{F_f}$
force of friction (along the plane, opposite

B. Resolve gravity force into normal component and parallel component whose magnitudes are:

$F_{G||} = m\ g\ \sin(\theta)$ and $F_{GN} = m\ g\ \cos(\theta)$.

C. The magnitude of the normal force due to the plane is equal in magnitude (but the direction is opposite) to the magnitude of the normal component of the gravity force:

$F_N = m\ g\ \cos(\theta)$.

D. The frictional force opposes the motion, and its magnitude is equal to the coefficient of friction times the normal plane force:

$F_f = \mu\ m\ g\ \cos(\theta)$.

E. The net force (which is along the plane) is the difference between the parallel component of the gravitational force and the friction force; its magnitude is:

$F = m\ g\ \sin(\theta) - \mu\ m\ g\ \cos(\theta)$.

F. The acceleration is net force over mass:

$a_{||} = g\ \sin(\theta) - \mu\ g\ \cos(\theta) = g\ (\sin(\theta) - \mu\ \cos(\theta))$.

G. The numerical answer is (given to two significant figures since the given numbers have two):

$a = (9.8\ m/s^2)\ (\sin 27^o - 0.19\ \cos 27^o) = (9.8)\ (0.454 - 0.19 \times 0.891) = 2.79 = 2.8\ m/s^2$.

7. When you look over this answer to see if it makes sense, try doing the problem by substituting numbers in at each step (the concrete approach). The weight of a kilogram, for example is 9.8 N. The normal (perpendicular to the plane) component of the gravitational force is 9.8 times cos 27^o or 8.73 N. This makes sense, for if the angle were very small, the normal component of the gravitational force would be almost equal to 9.8 itself. Notice that although the final answer should be given to two significant figures, you should keep three in these intermediate calculations.
   The parallel component of the gravitational force is 9.8 sin 27^o = 4.45 N. The normal force due to the plane is equal in magnitude to the gravitational normal force (but opposite in direction), and so the frictional force is 0.19 times 8.73 or 1.66 N. The net force is down the plane and equal to the difference 4.45 - 1.66 = 2.79 N. Divide this value by 1 kg to get the acceleration 2.79 m/s^2 (which is rounded off to 2.8 m/s^2).
   Again examine your solution. It says that the block does accelerate down the plane because the final answer is positive. The acceleration is less than g, again a reasonable result. Notice that if the angle were more than 27^o, then its sine would be larger and its cosine smaller, so the acceleration would be greater. If the angle were less than 27^o then the opposite would be true, and the acceleration, as calculated above, could become negative. But a negative value for acceleration would be wrong, because that would say that the block would accelerate up the plane because the frictional force dominates, and that is impossible. Instead, if the calculation had produced a negative value for a, you would have had to change the solution to a = 0, meaning that the frictional force was enough to prevent sliding.
8. Now anticipate how you'd do this problem on an exam. Is the concrete approach faster and easier for you? Or would you be more comfortable using the formal approach on an exam? It is a good idea to practice doing this problem when you study for an exam, if you think a similar problem will be asked.

Effective Test Preparation

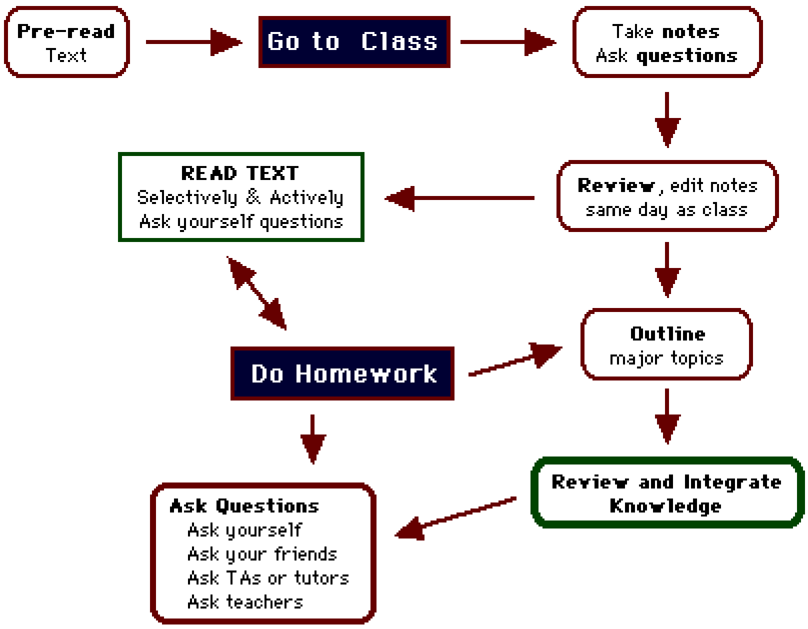
If you have followed an active approach to study similar to the one suggested in this handout, your preparation for exams will not be overly difficult. If you haven't been very active in studying, your preparation will be somewhat harder, but the same principles still apply. Always remember: Physics courses, and therefore physics exams, involve **problem solving**. Hence, your approach to studying for exams should stress problem solving.
Here are some principles:

- In the **week prior** to the exam, follow the three steps below. These steps should give you a reasonably good idea of what has been stressed and on what you can expect to be tested.
  @. Review your **notes** and recheck the course outline. Your goal at this point is to make sure you know what has been emphasized.
  A. Reread your solutions to the **homework** problems. Remember that these solutions, if complete, will note underlying principles or laws.
  B. Review the assigned **chapters**. Once again, your purpose in this early stage of exam preparation is to make sure you know what topics or principles have been emphasized.

- From this rapid overview, generate a list of **themes**, **principles**, and types of **problems** that you expect to be covered. If samples of previous exams are available, look them over, also, but do not assume that only previous types of problems will be included. It definitely helps to **work with others** at this stage.
- **Review actively**. Don't be satisfied with simple recognition of a principle. Aim for actual knowledge that you will be able to recall and to use in a test situation. Try to look at all the possible ways that a principle can be applied. Again, it helps to work with others and to explain things to others (and have them explain things to you).

  For example: If velocity and acceleration principles have been emphasized in the course, look over all of your homework problems to see if they illustrate these principles, even partially. Then if you also can anticipate an emphasis on friction and inertia, once again review all of your homework problems to see if they illustrate those principles.
- Effective examination preparation involves an **interaction** among homework problems, the classes, your notes and the text. Review actively, including self-tests in which you create your own problems which involve a combination of principles. You need to be sure that you can work problems without referring to your notes or to the textbook. Practice doing problems using both the concrete and the formal approaches, to see which you are more comfortable with.
- Remember that exams will include a **variety** of different problems. You want to look back on an exam and say, "I know how to do friction problems so well, that even though they were asked in a weird way, I could recognize them and solve them."

Weekly Flow Chart for Studying Physics



Tips

These tips are based on a list "17 Tips that UT Seniors Wish They'd Known as Freshmen" by Dr. John Trimble, a professor in the English Department. He is a member of The University of Texas's Academy of Distinguished Professors. These tips have been adapted to fit physics courses, but they are good tips for any university student. I have abbreviated most of these tips but have not omitted any. You can find the complete version at the **Learning Skills Center** (and elsewhere).

1. Get to know your professor. Go to his or her office hours early in the semester and often. Get to know your TAs. Go to their office hours early in the semester and often. UT Austin has faculty and graduate students who are among the best in the world; get to know them.
2. As soon as you can, trade names and phone numbers with at least two classmates. Don't ask the professor what you missed if you happen to miss class; ask your classmates.
3. Make sure you are enrolled in the course you think you are enrolled in. Correct any enrollment mistakes as soon as you can.
4. Read and study your course policy statement (the first day handout or the syllabus). It is a legal contract!
5. Buy and use an appointment book.
6. Keep a notebook of unfamiliar words and phrases. Look them up or ask what they mean. Buy and use a

good dictionary.

7. If you haven't yet learned to use a computer, do so. If you don't have a good calculator, which you know how to use easily, buy one and learn to use it. A particular calculator may be required for class; be sure you get the right one. Study its manual and practice using it until you can do so quickly and accurately.
8. Learn to touch-type. If you hunt-and-peck, you will be at a disadvantage. Learn either through a computer program or at Austin Community College.
9. Bring two calculators to each exam or one calculator and extra batteries. Bring your text book to each exam. Bring extra paper to each exam. Bring two pencils and two pens to each exam. Bring two blue books if required. Ask which of these you are allowed to use, but of course don't use the items that aren't allowed.
10. Go to each and every class session. Be punctual. Look professional. Don't disturb the class by talking. But do ask questions!
11. Exercise at least every other day.
12. When you write papers, do so in at least two editing stages, with a few hours or a day or two between drafts. Type your papers. When you write up homework problems, do so neatly and carefully. If possible, ask your professor, TA, or the grader for feedback before you turn in the final version of an assignment.
13. Understand that you are reinventing yourself. You are defining what and who you are for a good many years to come (you may want to reinvent yourself later, at 30 or 40), so be careful about how you go about it.
14. Hang out with the smartest, most studious people you can find. Watch how they work. Eventually people will be watching you; help them in developing good study habits.
15. Take the teacher, not the course. Shop for the best teachers by asking older students who they are and by reading the Course/Instructor student evaluations at the UGL's Reserve Desk. Try to meet prospective teachers before enrollment. Keep a "Best Teachers/Best Courses" notebook.
16. Assume responsibility for your own education. Exercise initiative. Learn to love the whole process of education, not just the end-product.
17. Dr. Trimble's seven reasons for going to college:
    - To meet a lot of interesting people, some of whom will become lifelong friends.
    - To gain an enlarged view of an enlarged world.
    - To learn better how to learn. (Most of what you later learn, you'll teach yourself.)
    - To reinvent yourself -- that is, to discover and explore more of yourself than you normally could at home.
    - To acquire at least a dilettante's knowledge about a lot of different things, since being informed beats the hell out of being ignorant.
    - To learn how to handle adult responsibilities while still enjoying a semi-protected environment.
    - To identify and explore career options.