

PHYSICS 101–102

INTRODUCTION

Philosophy, Policies and Procedures

PHYSICS: FROM THE PRACTICAL TO THE PROFOUND

Physics is a science which attempts to unify elements of the natural world by means of observation, mathematics, and the use of precise language. Using methods developed by physicists, we can describe many events that occur in our everyday lives. The principles of physics provided a basis for most of the technologies that are an essential part of modern life. In this sense, physics is *practical*. Many laws developed by physicists, such as the law of conservation of energy, are of tremendous practical importance. These same laws also help physicists understand the very tiny constituents of matter as well as the motions of giant clusters of galaxies. Thus the study of physics helps us understand some fundamental relationships between the matter in our surroundings and the evolution of the universe. In this sense physics is *profound*. You are about to begin your own exploration of the natural world using some of the concepts, tools, and methods commonly employed by physical scientists. Thus, you are beginning what we hope will become a grand journey from the practical to the profound that will continue long after you have completed introductory physics.

THE WORKSHOP PHYSICS PHILOSOPHY

In traditional science courses, attending lectures, reading a textbook, and solving problems are the primary learning activities. These activities are usually supplemented by a weekly laboratory session taught by an instructor other than the lecturer. The emphasis in traditional courses is on *what* you know.

Physics is fundamentally an experimental science. The theories, laws, and mathematical descriptions of the physical universe that have been created during the past 3000 years are based on the experience and observations of our ancestors. In Workshop Physics, the lecture and laboratory elements of the course are integrated so that your understanding of physics is enhanced by class discussions, personal reflections, observations, and experiments. Your ability to perform observations, take data, analyse results, and write reports will be enhanced by the use of a personal computer. The computer, when equipped with sensors and software, can be used for data collection and display, mathematical calculations, graphing, drawing, the simulation of physical events, mathematical modelling, and word processing.

The use of direct experience, new computer tools, and active participation will enable you to achieve an enriched set of learning goals. In addition to beginning to master an impor-

tant body of knowledge and learning how to solve traditional physics problems, you should be able to develop your reasoning ability and computer and laboratory skills to a much greater extent than you would in ordinary introductory physics courses. In fact, in Workshop Physics your powers of observation, reasoning ability, and the depth of comprehension of physical theories are considered to be far more important than any memorized facts, theories, or laboratory procedures. The critical question in this course is not "What do you know" but rather "How do you know what you know?"

OFFICE HOURS

The Physics Studio room will be open before and after the classes when possible. You can come in and preview the equipment or ask questions then.

STUDENT ASSISTANTS

Larger sections of the course will have one or two student teaching assistants (known as TA's) who have already completed introductory physics. Student assistants will be available to help you during class sessions ~~and during scheduled evening hours~~.

PHYSICS STUDIO HOURS:

Access to the Physics Studio may be possible outside class hours by prior arrangement.

REQUIRED MATERIALS:

You should purchase for the course

Principles with Applications, 6ed

2. The Text for the Course: *Physics: Custom Edition for SFU*, Giancoli
3. A clear plastic ruler (with a centimetre scale)
4. A clear plastic protractor.

Recommended –

5. A scientific calculator

BEFORE AND DURING CLASS – WHAT'S EXPECTED:

An Activity Guide has been developed to support the Workshop Physics approach to learning. In-class written work will consist primarily of documenting your class activities by filling in the entries in the "activity" spaces provided. You are encouraged to keep your own notes in the margins of the Activity Guide. *You should not wait until after class to fill in your guide. At the end of each class period your Activity Guide will be checked for completeness and stamped.*

Before coming to each class session, you should have completed the Activity Guide entries from the previous class session (hopefully in the previous class) and done the assigned

reading from the text or other documents. You should also have completed the assigned homework.

During class sessions, your willingness to discuss ideas with classmates, devise clever ways to measure or observe things, and make brief presentations using the board at the front of the classroom are important aspects of your participation in the course. *You are expected to be participating actively in the class sessions at all times.*

The use of the computer during scheduled class periods is restricted to course related activities. In particular, computer games may be hazardous to your mental health and detrimental to your class participation and other grades.

WRITTEN AND ORAL WORK

Activity Guide Entries

Activity Guide entries describe observations, derivations, calculations, and answers to questions. In the guide, the bold word **Activity** followed by a pair of numbers signifying the unit and activity number (e.g. **Activity 1-2**) indicates that a series of entries using *data, words, sketches, or graphs* is requested. Although you may use the same data and graphs as your partner(s) and discuss concepts with your classmates, all entries should reflect *your own understanding* of the concepts and the meaning of the data and graphs you are presenting. *Thus each Activity Guide entry must be written in your own words. Students who copy Activity Guide entries from current or old Guides will be reported for plagiarism.*

The pages containing the entries for each Unit are due at the beginning of the next class period after the Unit work is completed.

All of your Activity Guide units will be examined for completeness. In addition, several of your Units will be chosen at random to be carefully evaluated by one of the course instructors and given a percentage grade for quality and completeness. Instructors will look for complete sentences, clear expository writing, proper labelling of graphs and tables, the use of appropriate units with numbers, accuracy of calculations, the expression of results to the correct number of significant figures, and adherence to instructions. *It is ultimately your responsibility to see that your entries reflect a sound understanding of the phenomena you are observing and analysing.* Since these Activity Guide entries will be open to you when you take examinations, *it is to your advantage to create a set of entries and marginal notes based on in-class discussions and text book readings that are useful references as you complete examinations.*

At the end of the semester your Activity Guide scores will be translated into a percentage grade with 50% of the grade on it determined by the quality grades given by an instructor and 50% determined by the completion scores. *Activity Guide Units are due at the beginning of the class period following the class in which the last session activities are to be done.* Late Activity Guides take teaching assistants and instructors much longer to review.

In order to discourage late work, the grade on the Activity Guides will be reduced by 10% for each day or part of a day after the due date unless a written notification of illness is provided by a licensed medical doctor or the SFU Health Centre.

Homework Assignments

See update note on assignments at the end of this introduction

After each class session there will be homework assignments to complete; ~~the assignments are specified on pages appended to the end of the unit which you are currently working on.~~ Sometimes you will need to finish activities you started during class. This out-of-class work will typically take two or more hours to complete after each class session. A typical student can expect to work about 6 to 7 hours each week out of class.

Some of the homework assignments will consist of questions based on class activities, others are warm-up exercises involving simple reasoning and mathematics, while others are fairly difficult mathematical problems. Some of these will be adapted from problems in your text book. Each homework assignment is to be handed in at the beginning of the class session on the date that it is due. *No late assignments will be accepted.* Students who have been ill and have valid documentation of that illness should arrange with the instructor to hand in make-up assignments.

Homework should be submitted on the pages provided at the end of each unit or on an 8 1/2" X 11" sheet of paper headed with your name, the date, and your section number. In cases where textbook problems have been assigned, an assignment summary (for example, Ch 2 -#Q3, 13, 14, 21 should be placed on the header, if you are assigned question 3 and problems 13, 14, and 15 in Chapter 2).

Textbook Problem Assignments: If you want advice on how to solve problems we suggest:

1. Reading the problem solving guidelines of your text
2. Studying sample solutions in the text.
- 3 Studying sample solutions in other books of physics problems.

In the case of textbook-style problems full credit will be assigned for a correctly worked problem that contains a diagram, brief description of the physical situation and calculations. *You will receive at least half credit for seriously attempting to solve a problem using diagrams, descriptions, and mathematics even if your ultimate solution is incorrect. To receive partial credit you must explain in writing what approaches you have taken to solving the problem.*

Remember: In order to get full credit on a problem, the solution should contain a diagram of the physical situation, a brief written description of the situation, and calculations.

Homework solutions will be made available when the graded homework is handed back. Homework will usually be graded by an a graduate student or upper level undergraduate in physics. Your grader may occasionally make an error in judgement. *If you think this is the case, feel free to ask the instructor to review your homework assignment.* At the end of the semester your homework scores will be translated into a percentage grade.

You are encouraged to discuss and work on homework with classmates. However, you should write out answers to questions and problem solutions using your own format, equations, and words to reflect the understanding of the assignment. As is the case for Activity Guide Entries *any student who copies homework from another student will be reported for plagiarism.*

We have noted in the past that there is a strong correlation between the steady effort needed to successfully complete homework and performance on examinations. For example, during a recent year 7 out of the 8 students with exam averages above 90% had homework averages of over 80%.

EXAMINATIONS

There will be two midterm examinations during each semester as well as a cumulative final exam. Questions on these examinations will be based primarily on course activities and homework assignments. Emphasis will be placed on demonstration of the ability to apply the concepts and techniques learned to *new* situations. Material for the examinations will be drawn from the Activity Guide, assigned problems, and text readings as well as from oral presentations by the instructor. You may refer to personal notes based on oral presentations in examinations. In addition, unless we specify otherwise, *examinations will be open to the Activity Guides that you generated during the course. Examinations will not be open to the textbook, other books, homework assignments or solutions, published exam solutions, and other people's ideas.* You may use a graphing calculator.

Working old examinations, additional problems, and previously assigned problems, as well as reviewing assigned readings and your written Activity Guide work, is probably the best way to prepare for an examination. Although successful completion of examinations will require a working knowledge of key definitions, concepts, and problem solving techniques, *rote memorization of material will not help you to pass examinations.*

POLICIES

Exam Attendance - You are required to be present for all exams. Make-up exams will only be offered to students with medical documentation that indicates that a medical professional deemed them unable to take the exam on that day. You must have your doctor fill out the official SFU Medical Excuse document. You must also inform your instructor as soon as possible of an absence from an exam. The only other valid excuse from an exam is the documented death of an immediate family member. **This policy will be strongly enforced for the final exam with no exceptions.**

Health care provider statement form:

Cutting – Missing class without a valid excuse is discouraged because make-up classes will not be offered without a documented medical excuse.

Athletics – Participation in athletic events will not be considered a legitimate excuse for missing class. Athletes who have practice sessions or contests in the afternoons should try to take a morning section of the course to avoid conflicts. Student athletes who are away during an exam must arrange to have the exam proctored at the away location.

Making Up Excused Absences – Any class period missed for which there is a legitimate documented excuse must be made up at a time arranged for in advance.

Respect for Equipment – We expect you to be careful with the lab equipment. *At the end of every class period your table should be left with equipment arranged neatly, computer equipment off, and scrap materials thrown away.*

Late Work – Because it is helpful to your learning to have rapid feedback on your written work, the instructors will try to see that all work is graded as soon as possible. *It is very inconsiderate to expect an instructor or teaching assistant to grade late work once the same work from the rest of the students has been graded.* It takes 2-3 times longer to grade late work separately. For these reasons, your instructor will not accept home work assignments. The grades on late Activity Guide Units will be reduced by 10% for each day that they are late.

Academic Honesty – You are encouraged to discuss and debate the ideas in any of your assignments with your instructors, TA's, lab partners, and other classmates. If you work on assignments co-operatively, rather than independently, you may share ownership of spreadsheet, graph, and diagram files based on data you have taken with partners. However, *any other spreadsheet or written assignments must be expressed in your own words and reflect your own format details.* Thus, you may not copy (even with some modification) problem solutions or spreadsheet assignments, Activity Guide entries, or written material on examinations. *If there is reasonable evidence of copying, it will be construed as an act of plagiarism and will be dealt with according to the university policy on academic dishonesty.*

TIME COMMITMENT: 4 HR/WK + 6 HR/WK = 10 HR/WK

Understanding the science of physics and learning how to investigate natural phenomena on your own can be fun, but it also takes energy, patience, and time. How much time are you expected to put into introductory courses? What do we expect? How does that compare with the average study time at other colleges?

Most university and colleges recommend that students plan on working a minimum of two hours out-of-class for every hour spent in class. If Physics 101-102 were taught in the more traditional format of three lectures each week, we would be requiring an average of seven additional hours outside of the lecture setting. These hours would be spent in a one hour tutorial and six hours working informally, either independently or with classmates, to com-

plete assigned work. This adds up to a total of ten hours per week in course related activities. The workshop format of this course reallocates the three hours of formal instruction time plus one hour of tutorial into two 2 hour long sessions held in an environment where discussions, observations, and experiments can occur. However, *we are still expecting the average student to spend about six hours outside of class each week*. A survey of students at Dickinson college where this course was originally developed revealed that students put in an estimated average of 5.9 hours each week outside of class. There is, of course, a tremendous variation in the amount of time that different individuals put into the course. The time you need to spend will depend on a number of factors, such as how thoroughly you would like to learn the material, your natural ability, and the background you already have in mathematics, physics, equipment use, and writing. Although the amount of time you have to spend each week will vary, steady work from week to week will stave off the need to spend an unreasonable amount of time in any given week. The histogram below shows a distribution of average study hours among typical physics students.

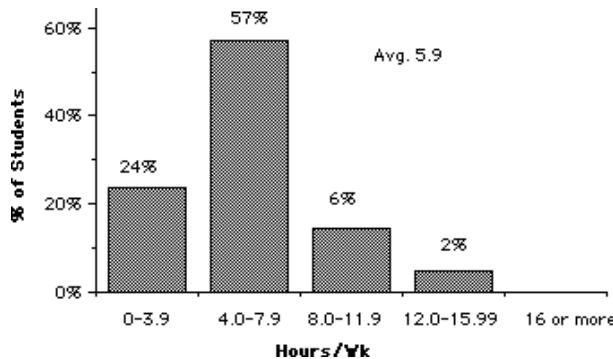


Figure 1: Histogram showing the percentage of Dickinson College students who responded to a survey in the fall of 1989 for different ranges of hours per week of out-of-class study.

Many students who have taken workshop physics have pointed out this course typically requires more work than their other courses. You might be interested in the results of a survey of physics students at Dickinson College (were this

course originated) and six other colleges and universities (the University of Oregon, Lynchburg College, Rutgers at Newark, the University of Nebraska, New Mexico State University, and Arizona State University). The average amount of work done at these institutions is similar. This is shown below.

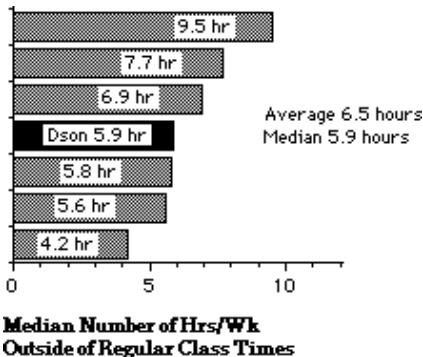


Figure 2: Bar Graph of the median number of hours spent in out-of-class study for introductory physics courses at seven colleges and universities.

Physics courses at SFU may require more work than many other courses you may have taken in high school or university, but the work load is not out-of-line with that required in physics at other colleges and universities. Learning how to analyse data, describe natural phenomena mathematically, and use new apparatus and computer tools involve high order thinking skills that

only come with practice. Former students who pursue careers or undertake graduate study in a number of fields of endeavour find the increase in thinking ability and the background

they have obtained to be extremely valuable. Although you will be expected to put considerable effort into the Physics 101 and 102 courses, we hope you will enjoy the activities and take a real pride in your growing ability to learn about the wonders of nature by conducting your own investigations using modern computers and scientific apparatus.

GRADING

Your grade will be based on a professional judgement of your work using the following weighting scheme as a guide:

| <u>PHYS 101 & PHYS 102</u> | |
|--------------------------------|------|
| • Term Examinations (2) | 30% |
| • Final Examination | 40% |
| • Written Homework | 15% |
| • Activity Guide Entries | 15% |
| TOTAL | 100% |

Note on Assignments

This semester we'll be using Mastering Physics online homework. If you bought a new textbook an activation code is included or you can buy one from the bookstore for \$50. You can also buy it online for \$59. You may be able to still use an account that was activated in a previous semester. (You can also buy a version that includes an online textbook for about \$98.)

Mastering Physics allows you to get immediate feedback on your problems and also has additional help and explanations available if you need them. In addition I'll also assign written problems which may be based on previous Mastering

Note on iClickers

Because this is a small class this semester I am not requiring iClickers for the class. We may use them for midterm review sessions if you already have one. If you do wish me to include iClicker questions in class please ask me and I'll try to.