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Introduction to the Calculus-based Physics Modules

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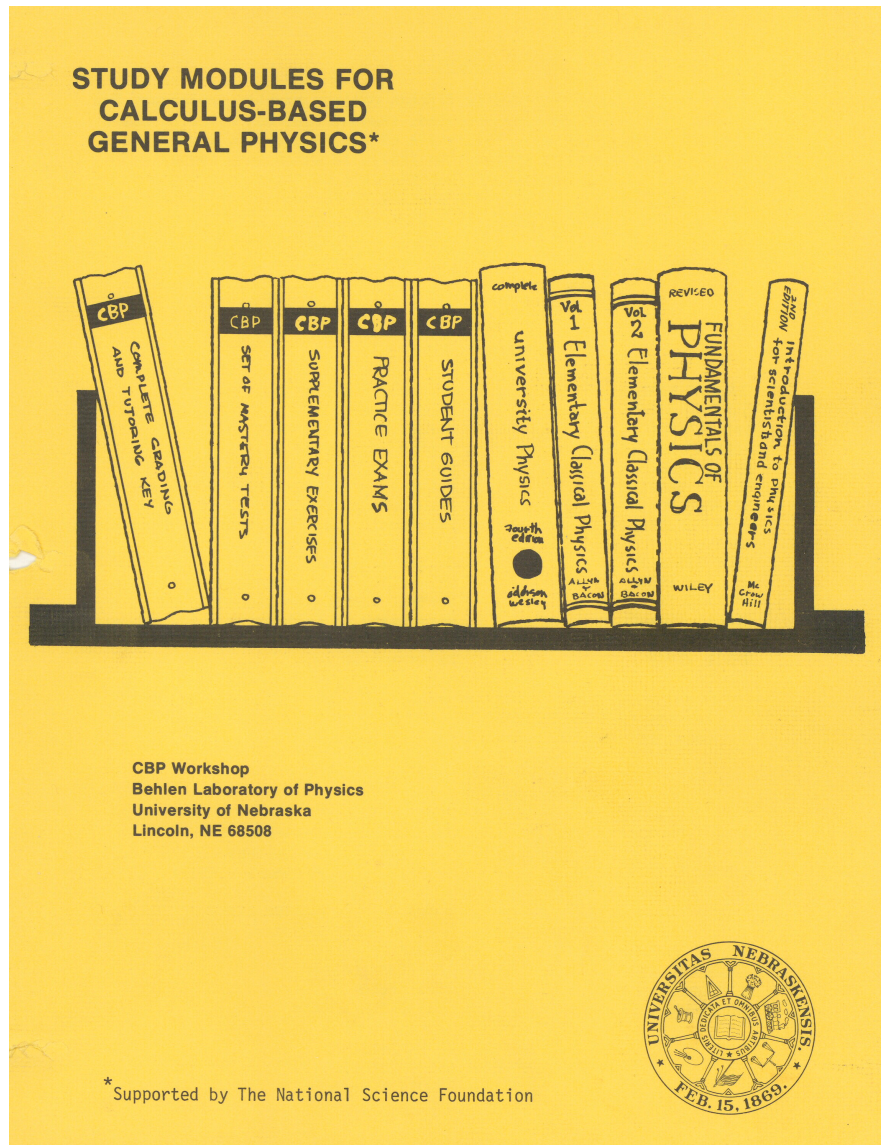
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Introduction to the Calculus-based Physics Modules



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Comments

These modules were prepared by fifteen college physics professors for use in self-paced, mastery-oriented, student-tutored, calculus-based general physics courses. This style of teaching offers students a personalized system of instruction (PSI), in which they increase their knowledge of physics and experience a positive learning environment. We hope our efforts in preparing these modules will enable you to try and enjoy teaching physics using PSI.

Robert G. Fuller
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These modules were prepared by the module authors at a College Faculty Workshop held at the University of Colorado - Boulder, from June 23 to July 11, 1975.

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WHY

TRY

PSI?

The personalized system of instruction (PSI)¹⁻³ has been used in physics courses in a number of colleges and universities for several years. Studies have shown that in some cases the students in a PSI physics course learn physics better than students in a lecture course. In almost all cases, a majority of the students prefer the PSI course to the lecture course, yet they report working harder in the PSI course. Why is it that this system of instruction is not more widely used? At least one reason is the large effort required of the PSI instructor to develop the study modules for his course. We have written these modules to enable you to use PSI in your calculus-based physics course. With these modules we believe the effort required to use PSI will be greatly reduced. We hope you will give PSI a try.

¹For study modules on the use of these CBP Modules, see Appendix A.

²J. Gilmore Sherman, (ed.) Personalized System of Instruction, 41 Germinal Papers, A Selection of Readings on the Keller Plan, (W. A. Benjamin, 1974)

³Fred S. Keller and J. Gilmore Sherman The Keller Plan Handbook, Essays on a Personalized System of Instruction, (W. A. Benjamin, 1974)

NOTE TO THE INSTRUCTOR

You need to make several specific decisions as you prepare for the student use of these materials.

1. You must select a textbook. These materials are not intended to be used independent of other reading and study materials. In fact, these modules have been keyed to four different calculus-based general physics textbooks.⁴ If you wish your students to read only one of these books, you may remove the pages in each module that refer the students to the other textbooks. We intend that these materials can be easily adaptable to any other general physics textbook that you choose, but you will have to provide the suggested study procedures for such a text.
2. You should select a sequence in which you wish your students to study these modules and your selected text. We have labeled these modules by their physics content and provide a flow chart for you on pp. 2 and 3 of Preparation of Your Orientation Module. You may wish to give them numbers to suggest a learning sequence for your students. In general, your students will find a sequence that follows your selected textbook preferable to other sequences.
3. You may need to prepare an orientation module for your students. We have provided a study guide to assist you in the preparation of an orientation module. (See the next page.) If you have never taught using the self-paced, mastery-oriented, student-tutored style of instruction, known as the personalized system of instruction (PSI) or Keller Plan, you will find it useful to read the references given on the previous page.
4. You may wish to provide additional learning activities for your students. We have found that film loops and audio tapes can be very useful to students. We have provided in our modules some references to film loops. You can provide audio-tape instructions about problem solving as you wish. The task of working a problem while listening to suggestions from you on a cassette tape can be a good learning experience for your students.

These modules, each of which includes a student study guide with worked problems and a practice test, as well as equivalent mastery tests and grading keys, provide the basic written ingredients for a PSI calculus-based general physics course. You can also use these materials to improve a traditional lecture-recitation course, through the use of enriched homework assignments, repeatable testing, or in other ways.

¹Frederick J. Bueche, Introduction to Physics for Scientists and Engineers (McGraw-Hill, New York, 1975), second edition.

²David Halliday and Robert Resnick, Fundamentals of Physics (Wiley, New York, 1970; revised printing, 1974).

³Francis Weston Sears and Mark W. Zemansky, University Physics (Addison-Wesley, Reading, Mass., 1970), fourth edition.

⁴Richard T. Weidner and Robert L. Sells, Elementary Classical Physics (Allyn and Bacon, Boston, 1973), second edition, Vols. 1 and 2.

PREPARATION OF YOUR ORIENTATION MODULE

INTRODUCTION

Perhaps you have walked into a large shopping center and wandered around looking for the items you came to purchase. The feelings of lostness you had may be similar to the feelings of students as they wander into a self-paced, mastery-oriented, student-tutored physics course. As the instructor, you need to provide them with the assurance that all is well because you know where everything is (if you don't, please read Appendix A). You also need to provide your students with a road map and catalog for your physics course. This combination road map-catalog is often called the orientation module. (If you want your orientation module to match the CBP modules have it typed on an IBM Selectric 12 pitch typewriter with letter gothic type.)

PREREQUISITES

Before you begin this module you should be familiar with the personalized system of instruction (See Appendix A) and the content structure of the physics textbook you have chosen for student use.

LEARNING OBJECTIVES

After you have mastered the content of this module, you will be able to write an orientation module for your course which contains:

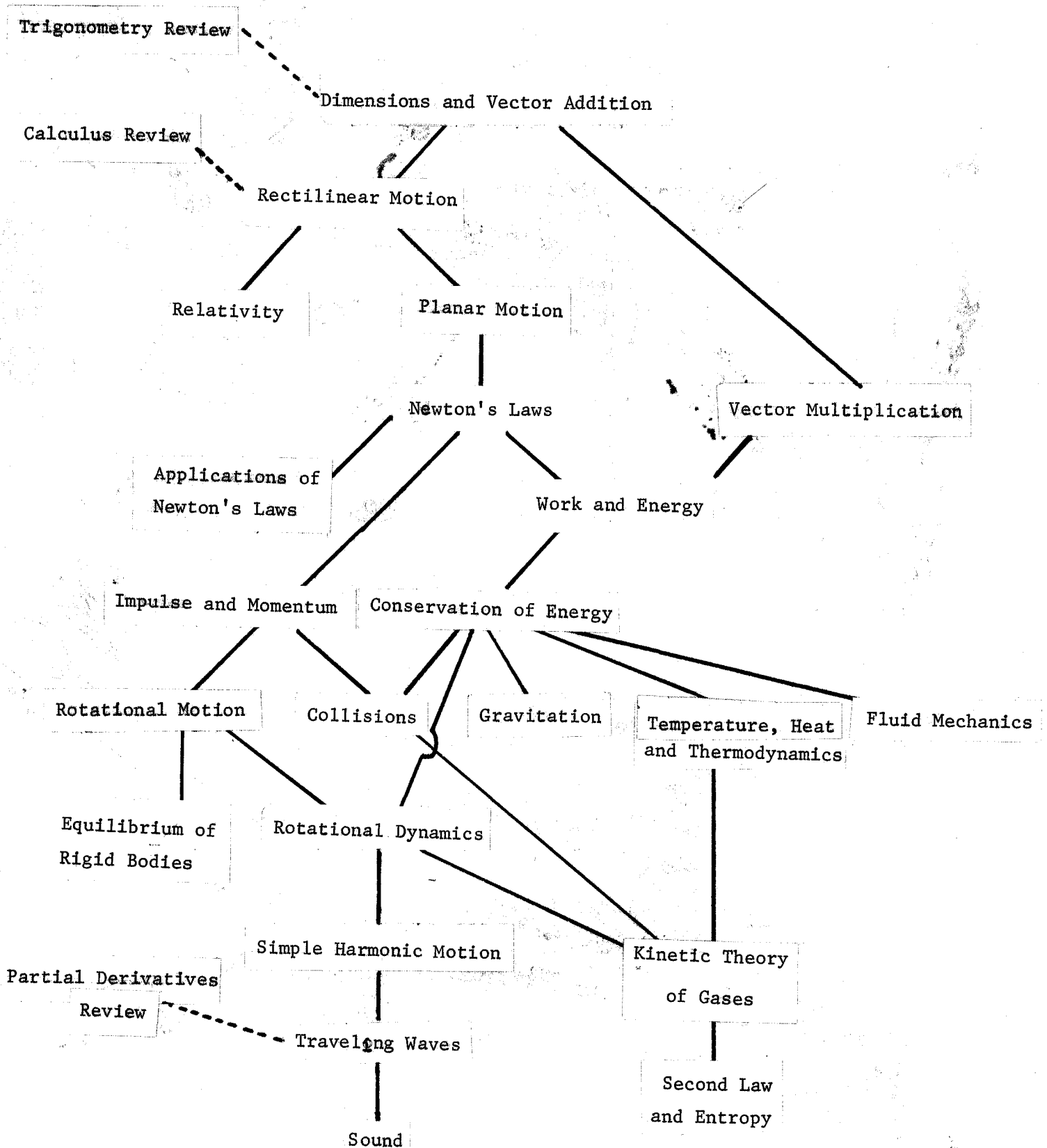
1. A description of the organization of the physics modules and the format of each module.
2. A suggested procedure for student progress in completing the modules.
3. An identification of the resources for learning and of their availability.
4. A statement of the requirements and responsibilities of students.
5. An explanation of the grading policy.

GENERAL COMMENTS

The orientation module you must prepare serves as the introduction of your students to your PSI physics course. For many students this may be their first experience in a course that requires so much active involvement from them. The self-pacing feature of PSI will demand that each student take responsibility for the effective use of his study time. The repeated testing enables students to perfect their problem solving skills. Your orientation module is to encourage your students to develop these personal attributes.

SUGGESTED STUDY PROCEDURE

To complete Objective 1, you must become familiar with the structure of the physics textbook you have chosen. You need to know what the prerequisites are for the various textbook chapters. The CBP study modules we have prepared are a compromise between the sequence of physics topics in four textbooks. You may wish to rearrange the sequence in which you use these modules or you may change the sequence of topics in the textbook. Examine the following prerequisite charts for the CBP modules.



CBP Content and Prerequisite Description

