

## **Assessment Package**

# **Force, Motion, And Energy**

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# Introduction

## General

The Chapter Tests and Lab Tests in this package are intended to help you assess the progress of your students in the course. For a discussion of the context in which the tests were written, please refer to the section on Assessing Achievement on page xvii of the *Teacher's Guide and Resource Book*.

## A Different Kind of Multiple-Choice Question

The multiple-choice questions in this volume are different from those you usually see. All too often, multiple-choice questions contain no explicit question; all the students are required to do is to “fill in the blank.” Such “questions” provide no information about students’ thinking. However, multiple-choice questions can test for understanding and the ability to apply knowledge to new situations *if they are constructed properly*.

Good multiple-choice questions are *bona-fide* questions that do not require looking at the choices to find the answer. Students should approach each question as if it were an essay question, first composing an answer and only afterward looking for their answer among the choices. When the presented choices reflect common errors or misconceptions, then even wrong answers have a concrete diagnostic value.

To see for yourself to what extent the *FM&E* Chapter Tests live up to this standard, see whether the questions can be answered without reading the choices. Then ask yourself what mistakes your students are likely to make, and check to see whether at least some of these mistakes are reflected in the choices.

Multiple-choice questions take less time to answer and less time to grade than essay questions. Therefore, more material can be covered in a given time. These are their strengths; their weaknesses are that they give only indirect information about students’ thinking processes, and they provide no outlet for creativity.

The first weakness has been significantly ameliorated through our selectivity in choosing the questions, as described above. To address the second weakness, we have included two essay questions in each of the chapter tests.

## Essay Questions

If you wish to see further expressions of your students’ thought processes, the *FM&E* testing package gives you a number of options. First, you can request that each student write a rationale for his or her choice for one or two questions. Second, you can convert selected multiple-choice questions into essay questions simply by covering the choices before you reproduce the test for class use. If you do that, be sure to announce beforehand that these questions should be answered in detail, with all the work shown, in a sequence of complete sentences.

Of course, essay questions take more time to complete than multiple-choice questions. In their present form, the chapter tests can be completed in one period. If too many questions are changed to essay form, more time may be needed.

We recommend that the tests be given as open-book and open-notebook tests. The positive effect of open-notebook tests on students’ study habits has been widely demonstrated. Any students who think that the availability of open notebooks and open books means that they will not have to study regularly will recognize their mistake after the very first test.

The *FM&E* course was designed for and is being used by a broad spectrum of students. The relative emphasis on the development of generalizations and concrete experiences var-

ies from class to class. In some classes, more emphasis is placed on developing students' ability to generalize from their experience in the classroom; in other classes, the learning is directed more to the concrete.

The tests were designed to provide the broadest possible spread. They were not designed to be graded on a fixed-percent basis, i.e., 90% is an A, 80% is a B, etc. The best way to evaluate the test results is to use the class average for correct responses as the basis for an average grade. You may want to caution your students not to expect the same percentage of correct answers as they are accustomed to with other multiple-choice tests.

### **The Diagnostic Software**

Utilizing the Chapter Tests to their fullest extent — not simply for the assessment of student achievement but as a tool for improving instruction — requires extensive analysis. The Diagnostic Software provides individual scores, class results, and a diagnostic interpretation of many of the incorrect choices. The output of the comments is available in two forms, a Class Report and an Individual Report. The Class Report highlights trouble spots by listing all the comments associated with incorrect choices made by at least 10% of the class. This report will help you recognize where the trouble spots are. An Individual Report is useful in a personal discussion with a student or a parent.

The software prints answer sheets for each test, which makes data entry from the keyboard extremely fast. A master copy for all the tests is included at the end of this book.

### **The Lab Tests**

Many of the questions on the Chapter Tests relate to experiments; however, no pencil-and-paper test can take the place of an authentic hands-on test. In fact, you may find that the students who do well on the Lab Tests are not necessarily the same ones who do well on the Chapter Tests. Like the Chapter Tests, these Lab Tests can help you judge the effectiveness of your teaching.

A statement of the problem to be solved in the laboratory accompanies the teacher's notes on each test. Enlarged masters to be duplicated for the students are found on pages 47–49. You may wish to distribute the Lab Tests one day in advance so that students will have time to plan their investigations.

When you distribute the Lab Tests, tell your class what resources will be available to them. In addition to the standard *FM&E* equipment and materials, students should be allowed to use their textbooks and notebooks. The investigations reflect the practices of the real world, in which references are available and the emphasis is shifted from memorization to practical and reasoning skills.

We strongly suggest that, as an integral part of the Lab Test, each working group submit a written plan before beginning the investigation. Such a plan will not only save students from beginning the test without appropriate thought. It should also prevent more perceptive students from unintentionally supplying possible procedures to their classmates. The plan may be used as part of the total test grade, so that students will realize the value of proper planning.

Inform your students that their work will be evaluated on the basis of the reasoning they apply to the investigation and the skills they show in the laboratory. Make it clear that the evidence they offer to support their conclusions is far more significant than any lucky guess.

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# **Answers to Multiple-Choice Questions and Suggestions for Evaluating Answers to Short Essay Questions**

This section contains the answer key to all the multiple-choice questions, and a brief rationale for answers. The interpretations of many of the wrong choices are provided by the Diagnostic Software.

As many of the short essay questions are open-ended, attention is called to the main points that should be covered in the answers.

## **Test 1**

### **Answers to Multiple-Choice Questions**