

PRECONCEPTIONS IN MECHANICS: LESSONS DEALING WITH STUDENTS' CONCEPTUAL DIFFICULTIES

Second Edition

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Available at this time: Complete Author's Proof of Second Edition of *Preconceptions in Mechanics*; approx. 390pp. on 195 sheets, punched for 3 ring binder.

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Description of PRECONCEPTIONS IN MECHANICS

This 390 page book contains a set of 24 innovative lessons and labs in mechanics for high school physics classrooms that was developed by a team of teachers and science education researchers, with funding from the National Science Foundation. The lessons deal with areas where students have qualitative preconceptions-- ideas that they bring to class with them prior to instruction in physics. Research has shown that certain preconceptions conflict with modern physical theories and seem to resist change when using traditional instructional techniques. The motivating idea for this book is to provide a set of lessons that are aimed specifically at these particularly troublesome areas and to provide special techniques for dealing with them.

The book deals with seven topics: *normal forces, friction, Newton's third law, relative motion, gravity, inertia, and tension*. The ideas in the lessons can be used to supplement any course that includes mechanics. Each unit contains detailed step by step lesson plans as well as background information on common student misconceptions, the overall integrated teaching strategy, and key aspects of the targeted core concepts. These lessons were initially field tested in standard, upper, and lower level high school physics classes, and extensively revised on the basis of classroom observations over a three year period. The second edition has a number of substantial changes based on teacher input. Many smaller adjustments have been made throughout the book to add clarity and improve the lessons. A number of the lessons are adaptable for college level courses as well.

The lessons use techniques such as class discussion of key examples, simple demonstrations, students "voting" on issues, and some laboratories that use easily found materials. Each lesson has been evaluated and improved twice and then given a final evaluation in a third year of testing. Evaluations using pre and post tests have shown large gain differences (reaching about one standard deviation or more in six of the seven areas) over control groups. The size of these measured improvements over traditional instruction is much larger than those seen in the great majority of educational studies.

The lesson guides do not form a text for students, but rather a resource book for teachers who wish to increase the level of conceptual understanding attained by their students and who would welcome help in addressing these troublesome topics. The lessons have been successfully evaluated with students in both accelerated and standard physics classes. The lessons have been successful in some of the most difficult to teach topic areas in science-- topics that are fundamental pre-requisites for further learning in physics.

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