FIRST LESSONS IN THEORETICAL MECHANICS

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JOHN F. TWISDEN

FIRST LESSONS IN THEORETICAL MECHANICS

Trieste

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IN

THEORETICAL MECHANICS

BY THE

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PREFACE.

In writing the following pages, I have had in view the wants of a rather numerous class of readers—those who wish to study the first principles of mechanics before they have obtained the knowledge of geometry, algebra, and trigonometry, which most elementary books on the subject presuppose. Some knowledge of arithmetic and geometry, it is true, must be assumed in discussing the most elementary questions as to forces; but I have found on trial that a very large portion of the principles of mechanics admits of exposition and illustration without demanding of the student a knowledge of more than arithmetic, a few rules in mensuration, enough geometry to make accurate diagrams with compasses, scale, and protractor, and enough algebra to solve a simple equation. No more than this is needed for the study of the following pages, with the exception of Chap. VI., *on motion in a circle*, and a few articles and examples, occurring, for the most part, towards the end of the book.

It will be proper to observe here that a good deal of choice has been exercised both as to the contents of the book, and as to the order in which they have been arranged.

Thus, the methods of finding centres of gravity and moments of inertia being in reality branches of geometry, have not been treated more fully than was necessary for the purposes of the present volume. Again, any fact or theorem has been taken for granted without proof whenever this seemed to conduce to the clear exposition of the matter in hand, e.g. the principle of the parallelogram of forces has been assumed without proof in Chap. III., though further on in the volume Newton's proof is given. However, most of the theorems of elementary mechanics are demonstrated, as this was found to be the most convenient way of putting them effectually before the student. In discussing the equilibrium of a body, the cases in which it is acted on by two or three forces are fully considered, but very little more has been attempted, partly on account of the great importance of the second case—that of three forces—which marks it out as calling for a full discussion; partly because a complete treatment of the case of n forces would have unduly lengthened, and have been inconsistent with the purpose of the present work. The answers to most of the examples and questions of the third chapter are intended to be obtained by diagrams drawn to scale; even if the student knows enough trigonometry to calculate them, he will find it a most useful exercise to obtain them graphically—a method which admits of extensive development, and is, I believe, largely employed by engineers. In the chapter on motion in a circle, something more is given than the motion of a particle; the treatment is necessarily imperfect, but I hope enough is done to throw some light on the motion round a fixed axis of a body symmetrical to a plane at right angles to the axis—the case that commonly occurs in machinery.

It is not necessary to specify here the contents of the book; I will only add that I have endeavoured to explain as clearly as possible the leading ideas of the subject, to illustrate them by a great number of examples and questions, and to get rid of all difficulties that are not inherent in the subject. How far I have succeeded is another question; but in case any of my readers find the book hard to understand, it may be well to add that when all that is possible has been done in the way of exposition and illustration, the subject will still present difficulties to most beginners; in fact, it does not admit of an easy and familiar treatment, and 'is not to be understood without that degree of attention which the very nature of the thing requires.'

J. F. TWISDEN.

July 1874.

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