

**CLASS BOOK OF ELEMENTARY
MECHANICS. AN
INTRODUCTION TO NATURAL
PHILOSOPHY. PART II. - FORCE**

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Class Book of Elementary Mechanics. An Introduction to Natural Philosophy. Part II. - Force by
William Hewitt

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WILLIAM HEWITT

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CLASS-BOOK
OF
ELEMENTARY MECHANICS.

CLASS - BOOK
OF
ELEMENTARY MECHANICS.

An Introduction to Natural Philosophy.

ADAPTED TO
THE REQUIREMENTS OF THE REVISED NEW CODE.

PART II.—FORCE.

BY
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PREFACE.

THE following lessons deal with the subjects comprised in the second and third stages of Mechanics, as defined in the New Code. Lessons 1 to 27 inclusive, on Force and Energy, treat of the subjects included in the second stage; and the Examination Questions following Lesson 27 bear on those subjects. The remaining lessons are mainly devoted to the mechanical powers, the principal subject of the third stage; and a large number of exercises and problems are given at the end of the several lessons. The Examination Questions at the end of the volume bear upon the subjects of the third stage. More than 450 exercises altogether are given in this volume, a large number of which are original, the others being for the most part selected from various examination papers.

The complete work, consisting of this and the preceding volume, will, it is hoped, be found to provide a sound though elementary introduction to the study of Natural Philosophy.

W. H.

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CLASS-BOOK OF ELEMENTARY MECHANICS.

PART II.

LESSON 1.

MATTER AND FORCE.

Matter is the general name given to those substances with which we become acquainted by means of our senses. The various substances of which the solid ground is composed, the water of the ocean, and the air which surrounds us invisibly on all sides, are all included under the general term "matter." Notwithstanding the many various forms which matter assumes, we find when we consider their properties that they can all be arranged under three classes, known respectively as **solids**, **liquids**, and **gases**. Certain properties are common to all kinds of matter, such as **weight** (or more correctly gravitation), and **extension**. All the portions of matter with which we have practically to deal have also the property of **divisibility**, that is to say, they may be divided into still smaller portions. There are many reasons for believing that it would not be possible to carry this process of division of a body beyond a certain limit, without changing the nature of the body. The smallest particles of a body are called **molecules**. In solids the molecules have a definite and fixed position in the mass; in liquids the molecules are free to move among themselves, and to change their position, without, however, leaving the mass; in gases the molecules have no definite position, but are free to move independently of each other.

Some of the bodies that we see around us are in a state of **motion**, others in a state of **rest**. By motion we mean change of position, and we consider a body as being in motion when we find it occupying different positions at different times. If a body is observed to remain constantly in the same position we consider it as being at **rest**. Everything with which we are acquainted, ourselves included, is in reality in a state of motion. We are altogether unacquainted with such a state as absolute rest. When, therefore, we speak of a body as being at rest, we mean that it is at rest relatively to ourselves, or to some particular part of the earth's surface.

When we want to change a body from a state of motion to a state of rest, or from rest to motion, we find it necessary to make an effort, or, in other words, to use some **force**. To lift a stone from the

