
Elements of natural philosophy

Kelvin William Thomson

Title: Elements of natural philosophy

Author: Kelvin William Thomson

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ELEMENTS
OF
NATURAL PHILOSOPHY.

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ELEMENTS

OF

NATURAL PHILOSOPHY

BY

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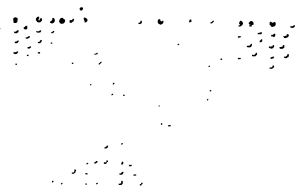
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PREFACE.

To the first Edition of this work, published in 1872, the following statement was prefixed :—

“The work consists, in great part, of the large-type, or non-mathematical, portion of our Treatise on Natural Philosophy.

“As it is designed more especially for use in Schools and in the junior classes in Universities, the mathematical methods employed are, almost without exception, limited to those of the most elementary geometry, algebra, and trigonometry. Where higher methods are required for an investigation, the reader is, in general, simply referred to our larger work.

“It is particularly interesting to note how many theorems, even among those not ordinarily attacked without the help of the Differential Calculus, have here been found to yield easily to geometrical methods of the most elementary character.

“Simplification of modes of proof is not merely an indication of advance in our knowledge of a subject, but is also the surest guarantee of readiness for farther progress.

“A large part of Chapter VII is reprinted from a series

of notes of a part of the Glasgow course, drawn up for Sir W. Thomson by John Ferguson, Esq., and printed for the use of his students.

“We have had considerable difficulty in compiling this treatise from the larger work—arising from the necessity for condensation to a degree almost incompatible with the design to omit nothing of importance: and we feel that it would have given us much less trouble and anxiety, and would probably have ensured a better result, had we written the volume anew without keeping the larger book constantly before us. The sole justification of the course we have pursued is that wherever, in the present volume, the student may feel further information to be desirable, he will have no difficulty in finding it in the corresponding pages of the larger work.

“A great portion of the present volume has been in type since the autumn of 1863, and has been printed for the use of our classes each autumn since that date.”

To this we would now only add that the whole has been revised, and that we have endeavoured to simplify those portions which we have found by experience to present difficulties to our students.

The present edition has been carefully revised by Mr W. BURNSIDE, of Pembroke College: and an *Index*, of which we have recognized the necessity, has been drawn up for us by Mr SCOTT LANG.

W. THOMSON.

P. G. TAIT.

January, 1879.

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DIVISION I.

PRELIMINARY.

CHAPTER I.—KINEMATICS.

1. THE science which investigates the action of Force is called, by the most logical writers, DYNAMICS. It is commonly, but erroneously, called MECHANICS; a term employed by Newton in its true sense, the Science of Machines, and the art of making them.

2. Force is recognized as acting in two ways:

- 1° so as to compel rest or to prevent change of motion, and
- 2° so as to produce or to change motion.

Dynamics, therefore, is divided into two parts, which are conveniently called STATICS and KINETICS.

3. In Statics the action of force in maintaining rest, or preventing change of motion, the 'balancing of forces,' or Equilibrium, is investigated; in Kinetics, the action of force in producing or in changing motion.

4. In Kinetics it is not mere *motion* which is investigated, but the relation of *forces* to motion. The circumstances of mere motion, considered without reference to the bodies moved, or to the forces producing the motion, or to the forces called into action by the motion, constitute the subject of a branch of Pure Mathematics, which is called KINEMATICS, or, in its more practical branches, MECHANISM.

5. Observation and experiment have afforded us the means of translating, as it were, from Kinematics into Dynamics, and *vice versâ*. This is merely mentioned now in order to show the necessity for, and the value of, the preliminary matter we are about to introduce.

6. Thus it appears that there are many properties of motion, displacement, and deformation, which may be considered altogether independently of force, mass, chemical constitution, elasticity, temperature, magnetism, electricity; and that the preliminary consideration of such properties in the abstract is of very great use for Natural