

**FIRST LESSONS IN
PHYSICS, FOR USE IN
THE UPPER GRADES OF
OUR COMMON SCHOOLS**

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First Lessons in Physics, for Use in the Upper Grades of Our Common Schools by C. L. Hotze

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SCHOOLS.

"In Nature all is Motion, Life, and Labor."—Lesson xxii.

BY

C. L. HOTZE,

*Teacher of Natural Science in the Cleveland High School,
Author of "First Lessons in Physiology," etc.*

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P R E F A C E .

The conviction that an elementary knowledge of some important instruments, machines and physical phenomena can and should be given in our Common Schools, has induced the author to prepare the present little volume. Its object is the presentation of a number of phenomena, laws, and applications of the same, specially adapted to the perceptive capacities of the pupils of the upper grades.

Inasmuch as the demand of a large amount of time might delay the introduction of physical science into the Common School, the book has been so prepared as to secure good results in the minimum of time ever given any study in our schools, viz. : one lesson a week.

Each of the thirty-nine lessons commences with a fact familiar to the child, or an easy little experiment, which serves as the basis for the development of a natural law. After this law, comes the application man makes of it—such as the barometer, thermometer, pump and hydrostatic press.

Costly apparatus is unnecessary. A pencil, a marble, a piece of board, of India-rubber, of wire; glass tubes, and

other objects of trifling expense, are sufficient, for our purposes even preferable. The steam engine and other complicated machines should be examined when in actual use at the workshop or other places, by the class in company with the teacher, but not until after the preparatory lesson in the school-room.

Like all instruction, instruction in physics should proceed in concentric circles from the near to the remote. The present volume may be considered as the first and smallest of those circles. Its usefulness in the highest grade of our Common Schools has been shown by practical experience; the author has written it, however, with a view of introducing it into the second, and even into the third.

At the end of every lesson, articles in books and popular magazines are pointed out, where the pupil may find interesting reading matter; and where, while thus improving his leisure time, he may collect material for composition exercises in school.

CLEVELAND, O., April 3, 1871

Preface to the Third Edition.

The hearty welcome given to the first edition of this work undoubtedly had its reason in the long-felt want of a text-book suitable for the thousands of girls and boys whose school education ends in the common school. Among the many things there learned, there are few things which they remember to greater advantage than the phenomena and daily applications of the laws of gravitation, the pressure of air, the lever, the pump, the steam-engine, and the telegraph. These realities train the observing powers, instill a love for knowledge, form a preventive against habits of superficial reasoning, and thus tend to diminish explosions, conflagrations, and other calamities, many of which are caused by persons ignorant of the powers of nature. The merchant, the laborer, or the manufacturer will do his work the better for having had his senses trained in observing nature's operations, and his mind disciplined by scientific thought. It may safely be stated that this view is held by most educators in this country, and that the time is fast approaching when physical science will no longer be a stranger in our common schools.

And yet there are a few followers of the cramming-system, who would deny the right of nature to a share in the education of the young; who would not teach about the things themselves, but merely their names and forms. These persons consider objective instruction in the lower grades of schools as simply a transient concession to ephemeral demands, although, during the last two centuries, such men as Cowley, Milton, Locke, Rousseau, Pestalozzi, Whewell, and Macaulay have advocated it. In the upper grades they refuse it admission altogether, notwithstanding its introduction there is urgently pressed by the scientific men of all countries, by the entire periodical press, and the most prominent educators of the world.

These few opponents to progress in education are joined by a still smaller class of persons who are not adverse to the introduction of

physical science into the schools, but who fear, lest the appropriation of time—one lesson a week!—might diminish the habitual number of arithmetical examples, geographical names, and grammatical rules, and thereby vitiate the results of the annual examinations. So some people entertain a groundless prejudice against the acquisition of a foreign language, on the plea that the child's English might suffer. Huxley, in his "Answers to Certain Questions by the Schools Inquiry Commission," says: "Physics lie at the foundation of all science; and if nothing else were taught, it would be a great gain to have the youth of this country soundly instructed in the laws of the elementary forces—gravitation, heat, light, and so forth." An English Journal, "Nature," says: "*The notion, that when a child has learned to read, write, and cipher, he is educated, must be eradicated. These are at best but means, and are only the instruments by which education is conducted.*" An editorial in the "Scientific American" (January 14, 1871), ends with the following significant words: "*As object teaching is a mere handmaid of science—is of use only to give scientific habits of thought, and to convey a knowledge of scientific facts, and is worthless without science, the public should see that its introduction into our schools be carried on under the advice of scientific experts, who shall direct what is best to be taught, and advise with the adepts in teaching how such knowledge may best be imparted. As a journal having the interests of science and education at heart, desiring to see science soundly popularized, and the masses made acquainted with its technical value, we make this suggestion, and furthermore ask: Is there any man of scientific attainments in the present Board of Education? Is there any scientific authority upon its general staff?*"

Physical science was introduced into the B and C grammar classes of this city last September; the pupils have now been using First Lessons in Physics for several months, and none of their other studies have been curtailed, yet the average of the monthly examinations does not suffer on that account, and, in the opinion of our teachers, it never will. A peculiar feature connected with the use of this book—one which we trust will not be brought forward as an objection—is, that the children ask a great many questions more or less to the point; and that they find no rest until they have received a satisfactory answer, either from the teacher's experiments or their own. The fact is truly surprising, that

the pupils of the C grade (sixth school-year) passed a very fair examination a few days ago, on questions at the end of the book which were not found too easy for the C grade of the High-school (the tenth school year). This shows what earnestness may accomplish; and we have but begun.

It may be well to state that the modern technical sense of a word sometimes conflicts with its preconceived English meaning, or use; and as a book of this kind demands language both youthful and technical, the author may be excused for having given a slightly different dress to not a few of the laws. He has omitted several of the so-called "properties" of matter which are very puzzling to the young; and, for the sake of simplicity, has treated the somewhat magic "impenetrability" of air as elasticity of air. The independent terms, Force, Motion, and Heat, are better understood by young pupils than Expansive Force, Moving Force, and so forth. The text in fine print, as well as pages 83, 84 and 120, must be omitted in a lesson of less than an hour's length. The development of the steam-engine will find favor from those appreciating the historical element in the school. While the lessons in Optics may claim special clearness in treatment, those in Chemical Electricity, being very difficult for young learners, will need forbearance. A two-fluid element was chosen, because it may be seen in actual use at the telegraph office. The questions in fine print serve for reviews and examinations, but not as equivalents for experiments.

Even a brief perusal of the volume will show the author's intention not to cram the pupil with meaningless facts, to be forgotten as rapidly as they are learned. As no special scientific qualification has been required of the teacher who, to-morrow, may be called upon to impart scientific instruction to her class, a text-book in the hand of the pupil seems for the present a necessity. I earnestly hope that my feeble contribution to so great a cause may not be judged by its shortcomings alone, and that the day may soon come when physical science shall form a regular branch of study in the common school.

CLEVELAND, O., December 1, 1871.