

**NATURAL PHILOSOPHY
FOR COMMON AND
HIGH SCHOOLS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649655410

Natural Philosophy for Common and High Schools by Le Roy C. Cooley

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Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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LE ROY C. COOLEY

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HIGH SCHOOLS**

NATURAL PHILOSOPHY

FOR

COMMON AND HIGH SCHOOLS.

1887

BY

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REVISED EDITION, WITH ADDITIONS

NEW YORK ··· CINCINNATI ··· CHICAGO
AMERICAN BOOK COMPANY

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PREFACE.

THE great aim of this little book is to present the most elementary facts of Natural Philosophy, in such a way as to exercise the child constantly in observing phenomena and in drawing inferences from what he observes.

Whenever a child is old enough to ask such questions, as "What makes the thunder," or, "Where does the rain come from," or to exclaim "How pretty the clouds are this evening," it is old enough to begin the study of natural philosophy. When such questions are asked the mind is awake to see the phenomena of nature, and is ready to receive instruction. They show the presence of a desire to know, and the absence of power to learn without assistance; and in this way they lead us to believe that the time has come when the work of instruction should begin.

Moreover, the study of natural philosophy is easy, and interesting to young pupils, because, when properly presented, it brings new sights to the eye, and new sounds to the ear, in a way to be especially pleasant to children. The simplest experiments awaken enthusiasm in the mind of a child, and such as he may be able to repeat by himself are the source of the greatest delight.

This study is not only easy and interesting, it is also in the highest degree beneficial to the young, partly because of the valuable facts it imparts, but even more on account of the mental power it develops. The object of primary education should be to discipline the senses to habits of quick and accurate observation, and the mind to the habit of forming correct judgments from facts which the senses reveal. Natural Philosophy furnishes abundant materials of the most excellent kind, by means of which these objects may be accomplished. There are curious motions, beautiful colors and harmonious sounds, together with numerous other phenomena, which can be easily presented in the form of simple experiments, by which the skilful teacher can cultivate the power of the senses to furnish correct impressions, and at the same time develop the power of basing accurate judgments upon the impressions received. In a word, this study when properly presented is eminently fitted to teach even young pupils *how to gain knowledge for themselves* by observing events.

To this end, the following plan ought to prevail in presenting elementary facts. An easy experiment or some phenomenon of common occurrence, is to be introduced and the attention of the child directed to certain appearances and conditions, after which he may be called upon to notice the truth which these appearances suggest. A concise and accurate statement of the fact or principle itself, in form to be easily remembered, may finally complete the investigation.

Many of the experiments are such as pupils can make for themselves: let them be encouraged to do so; if they are,

they will soon be bringing to the notice of the teacher, others which the text does not describe, and if the teacher will visit such efforts with marks of especial notice or reward he will soon find an enthusiasm in his class, which will make the pursuit of this study delightful and profitable to the end.

Another feature of this little book, which, it is believed, will commend it to the favor of both pupil and teacher, is the system of questions which runs through it. Every important topic in the discussion of each subject is introduced by a *question*, instead of by a *formal title*, as is customary. These questions will prove to be excellent guides, and really very important helps to the young pupil. The teacher will also find them serviceable in conducting the exercises of the class room, to which they are especially adapted, by being in immediate connection *with the text*, and in bold type *easily caught by the eye*, instead of at the bottom of the page or the back of the book, in fine print and compact lists. The eye catching them quickly, is not confined to the book; their use, therefore, will not be at the sacrifice of the vivacity and vigor of the exercise.

Albany, 1871.

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NATURAL PHILOSOPHY.

PROPERTIES OF MATTER.

Describe the experiment with cochineal.—If, to try an easy experiment, we take a single grain weight of cochineal, and dissolve it in as much as a thimbleful of water, and then pour this small quantity into a gallon of clear water, the whole gallon will receive a beautiful crimson color.

Into how many pieces has the grain of cochineal been divided?—Now a gallon of water is said to contain as many as 60,000 drops, and to color a single drop, all through, will take as many as 100 little particles of cochineal. If this is true, then the grain of cochineal must be divided into not less than *six millions of pieces!*

Can other bodies be divided?—If an apple be cut into 100 pieces, each piece will of course be very small indeed, but yet it will not be so small that it can not be divided into pieces smaller yet.

The blow of a hammer may break a pane of glass into a thousand parts, but each one of these little pieces may by another blow be broken into pieces still smaller.

What is divisibility?—Every body of matter may be cut or broken into pieces. This is one of the qualities or properties of matter, and we call it *divisibility*.

Divisibility is the property of matter in virtue of which a body may be separated into parts.

Are examples of great divisibility common?

—There are bodies all around us so small that we can not see them. They are in the air we breathe and in the water we drink. Some of them are alive and some are not. Many of them are so very small that we need the most powerful microscope to see them at all. Yet every one is made up of pieces or parts which are of course smaller than itself.

For example: the dust which clings to one's finger when he holds a butterfly or a moth is made up of very small particles, and yet each of these little particles of dust, which we can scarcely see with the naked eye, is found, by using the microscope, to be made up of a thousand or more little balls.

Are living creatures so very small?—And then, too, there are living creatures so small, that it may need as many as a million of them to make a pile as large as a mustard-seed. Hosts of them are living in the air and in the water all around us. They are so very very small that it has been said that a thousand of them might swim or fly side by side through the eye of a needle.

And yet each of these little creatures must be made up of still smaller parts, or else they could not move about nor devour their food, as all of them are able to do. We can not even imagine how very small these parts must be.

What are molecules?—If we keep on dividing a body into smaller and smaller pieces, we shall at last get