

**POPULAR CYCLOPAEDIA OF
NATURAL SCIENCE.
MECHANICAL PHILOSOPHY,
HOROLOGY, AND ASTRONOMY.
PART IV, PP. 317-575**

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Part IV, pp. 317-575 by William B. Carpenter

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WILLIAM B. CARPENTER

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PART
IV.



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POPULAR CYCLOPEDIA
OF NATURAL SCIENCE.



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HOROLOGY &
ASTRONOMY

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THE

POPULAR CYCLOPÆDIA OF NATURAL SCIENCE.

BY W. B. CARPENTER, M.D.,

AUTHOR OF "PRINCIPLES OF GENERAL AND COMPARATIVE PHYSIOLOGY," AND
"PRINCIPLES OF HUMAN PHYSIOLOGY."

THE omission of the study of Natural Science from the course of instruction generally followed in this country, appears a neglect of one of the most important means of intellectual discipline and moral improvement which the Almighty has placed within our reach. This study, rightly pursued, has for its object to enable us to read with understanding in that bright volume of Creation, the pages of which are daily and hourly unrolled before us. To every one do "the Heavens declare the glory of God," whilst "the Earth" shows itself "full of His goodness;" but most of all to him who has learned to interpret the wonders they display; and to trace, in the glorious works by which he is surrounded, His power, wisdom, and love.

As a means of intellectual discipline, the study of Natural Science is perhaps second to none. Habits of accurate, discriminating, unprejudiced observation; of cautious reasoning, and of sound judgment; together with a fearless love of Truth, are cultivated by it. Moreover, it has the advantage of interesting the pupil much more than the greater part of the ordinary routine of instruction; and will tend to increase his desire for the attainment of valuable knowledge of any description. Further, at the present day, when Science is constantly furnishing some new and important improvement in those Arts which minister so much to our comfort, and in their turn contribute in various modes to the expansion of the intellect, the practical benefit of a general acquaintance with its principles is sufficiently evident. And whatever portion may be destitute of such direct application, will be found to have uses of its own, in furnishing subjects for the healthy occupation of the thoughts, and objects of pursuit as rational and interesting relaxation.

No works at present before the public appear to be altogether suitable to this purpose; the greater number of *strictly Elementary* Treatises on Natural Science being little else than abridgements of larger works; so that they are much behind the present state of science, and are for the most part but inaccurate copies of one another, executed in a mechanical spirit, and destitute of the striking novelties which scientific research is constantly bringing into view. The Publishers have therefore determined upon bringing out a connected series of Treatises upon the principal departments of Natural Science, designed and executed in accordance with the views above expressed. It is intended that these should all be *founded* upon such knowledge as every person of ordinary capacity possesses, and that the attention of the reader should be directed in the first instance to phenomena of constant occurrence around him; and it is hoped that by a judicious mode of treating the subject, principles may be gradually developed in such a manner as to render them fully comprehensible, and their more extended application thus marked out. "The neglecting to form a proper connection with previously-acquired knowledge; the undervaluing the results of

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PREFATORY NOTICE.

THE following little Work is intended to occupy a place somewhat intermediate between the simpler elementary treatises on Physical science, and the more elaborate works of a professedly philosophical character. With the former, it has this in common—that the Author has aimed at adapting it to those who have no preliminary knowledge of the subject; and to carry on his readers, step by step, from the known to the unknown, without requiring from them more than an accurate acquaintance with the ground over which they have already passed. To the latter, the Author ventures to hope it may be compared in this—that the highest principles of the science are introduced, and exhibited in their connexion with each other, and with the phenomena they govern. He has thus endeavoured to give his little work the character of a philosophical treatise; whilst, by the number of examples and illustrations which he has introduced, he has aimed at preventing what might have otherwise been its dry and abstruse appearance. In this attempt, he has merely followed out the plan which has proved successful in the former volume of the present Series.

The only preliminary knowledge required for the comprehension of the whole of this treatise, is an acquaintance with ordinary Arithmetic, and with the rudiments of Geometry. The mere

beginner is recommended not to attempt to read the work straight through; but to omit Chapters V., VII., IX., and XII., until an accurate acquaintance has been formed with the rest; and not to proceed to the Astronomy, until a full acquaintance has been gained with the Mechanics.

The Author is well aware, that some parts of this Treatise may be deemed verbose and diffuse; and that the numerical illustrations may be thought to be too frequently introduced. To this he would simply reply, that some experience as a Teacher has convinced him of the necessity of explanations much more ample, and of illustrations much more complete, than those ordinarily given in elementary works; and that he has endeavoured to commit to paper the instructions which, when delivered verbally, were successful in impressing the minds of his pupils. The furtherance of this object has compelled him to extend the volume beyond the size originally contemplated, and it consequently becomes necessary to make a small addition to the price of the second Part.

In conclusion he would state, that, although a large part of the contents of this Treatise is the common property of all writers on the subject, many statements and illustrations may claim some degree of novelty. He thinks it right to add, that he is under particular obligation to the works of Professor Moseley, of King's College, London, for the assistance which he has derived from them in the first division of this volume; and to the Treatises of Sir J. Herschel, and Prof. Nichol, for a large part of the materials of the Astronomical portion of it.

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