

**RADIUM EXPLAINED: A POPULAR
ACCOUNT OF THE RELATIONS OF
RADIUM TO THE NATURAL
WORLD, TO SCIENTIFIC
THOUGHT, AND TO HUMAN LIFE**

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Radium Explained: A Popular Account of the Relations of Radium to the Natural World, to Scientific Thought, and to Human Life by Dr. W. Hampson

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TO SCIENTIFIC THOUGHT, AND
TO HUMAN LIFE

BY

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WITH ILLUSTRATIVE DIAGRAMS

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PREFACE.

Notice is hereby given that the following pages are not intended to serve as a text-book filled with facts and demonstrations arranged in the most convenient way for committing to memory with a view to a subsequent examination. Those who wish for a full account of the principles of radio-activity suitable for advanced students of physics, cannot do better than read the admirable works of Professors Rutherford and Thomson and Mr Soddy. But those works, like the papers on the subject communicated to the Royal Society, either bristle with mathematical formulæ, sometimes for pages together, or employ so many technical scientific phrases and implications as to be quite unintelligible to the ordinary lay reader.

Radium, however, and its lessons are matters of great importance and interest to all; and they deserve to be set forth in such a way that they may be understood of the people. This little book is written, accordingly, for the people—the more thoughtful section of course—that they may obtain some more systematic and intelligible information about radium than could be gathered from frequent disconnected and sensational articles in the daily press, or smart and “snappy” contributions to the monthly magazines.

This account is intended to make clear, in the first place, what there is in the processes underlying the nature and actions of radium to give them such a unique hold on the consideration of the scientific world, and to justify so much

general interest and surprise. Secondly, to show how the knowledge obtained in connection with the study of radium has modified scientific views as to the constitution of the material universe in which we live. Thirdly, to set forth impartially the limits of the practical benefit which we get from radium now, and the hopes that may be rationally entertained in that direction for the future.

This is a work of explanation. The scientific student must have the proofs of a proposition set forth in detail, that he may follow and justify them step by step. For the general reader it is more useful to explain the bearings of the proposition, and to explain the nature of the proof, in words and ideas which are not so unfamiliar as to deter him from the effort to understand. This object the author has kept so strictly in view, that he has not permitted himself to introduce so much as one equation; and if one single expression of an apparently algebraic nature has been inevitably employed, it has been so simplified as to be algebraic only in form. The whole book can be understood without more mathematical, physical, or chemical knowledge than form part of the common intellectual currency of mankind.

RADIUM EXPLAINED

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I.

THE PUZZLE OF RADIUM.

For more than twelve months radium has received an amount of public attention which is not often bestowed on a strictly scientific subject. Everyone is now familiar with the word at least, which has obtained such wide-spread recognition, that, besides seeing radium dances in ballets, we can buy radium collars, radium stoves, and radium polish. This sudden and extensive vogue is the more remarkable, since radium has not been made the vehicle of so many extravagant and dishonest promises of immediate revolutions in the industrial world, as was the case with electricity and liquid air in the early days of their development. The fame of radium has grown almost entirely from its really interesting and astonishing position in the scientific world. Its remarkable activities are shown on so small a scale in the minute specimens of it which alone exist, that one would hardly expect them to rouse the interest of many who can be easily impressed by the mighty power of the engines in an Atlantic liner, or the thousands of miles traversed by wireless messages passing from England to America. The fact that the general public have been so widely interested in radium, and so deeply impressed by it, is a remarkable testimony to the high position held at present by science, since the public have had to rely, for the most part, on their faith in the teachings of scientific men, both for their knowledge of the things that radium can do, and for their belief that its doings are surprising and deserving of the most careful attention.

What, then, can radium do, and why are its doings of a nature to cause such surprise and interest among men of

science? We will answer the latter question first. Radium, then, in the early days of our acquaintance with it, appeared to afford a contradiction to two of the greatest and most firmly established laws of nature—the conservation of energy and the persistence of matter. It is one of the greatest generalisations of modern science, that energy, however it may be changed from one form into another, is never, in our experience, destroyed on the one hand, or originated on the other. Whenever we see energy displayed, we can always trace it, if we have sufficient knowledge of the facts, to some previously existing form or forms of energy. The movement of the looms in a factory is a transformation of the expansion energy of the steam, that is, the movement of the steam molecules striking one another and driving one another farther apart. This is a transformation of the heat energy of the gases of combustion. The intra-atomic energies, which were transformed into a combustion-rush, were themselves transformations of the actinic vibrations of the ether which acted on the leaves of the growing plants out of which the coal was formed. These actinic vibrations were set up, at a distance of many millions of miles, by the vibrating particles of the sun: and if we are not yet all agreed as to exactly whence and how the sun obtained and maintains his enormous heat energy (radium is now one of the alleged sources), we are at any rate quite convinced that when a theory on this subject is generally accepted, it will prove to be one more instance of the great law that, wherever energy appears, it has been transformed from some previous manifestation of energy. If we take it the other way about, beginning with the sun, and ending with the factory looms, we readily perceive the converse truth, that, wherever energy disappears, it is not really destroyed, but only transformed into some other kind of movement, or movement in some other substance. Moreover, if we examine the matter quantitatively, weighing and measuring the energies involved in each successive pair of manifestations, we find that the force developed is always exactly equal to that out of which it was transformed. If the travelling energy of a moving train be added to the friction-heat energy of the wheels, axles, rails, and disturbed air, to the heat energy passing through the sides of the boiler into the atmosphere, and to the heat energy imparted to the