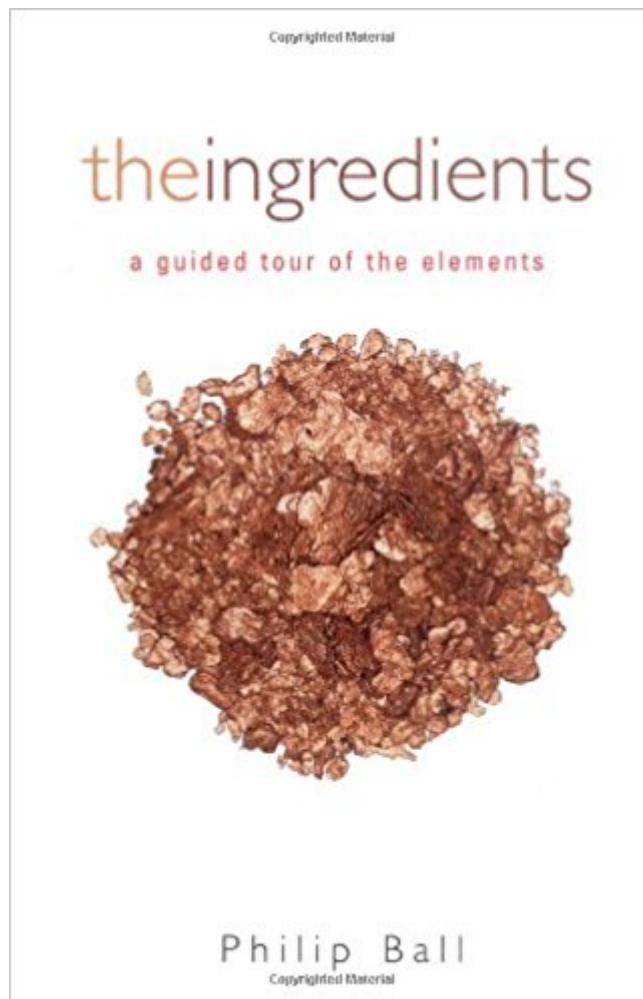


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# The Ingredients: A Guided Tour Of The Elements



## Synopsis

In *The Ingredients*, Philip Ball blends history and science as he offers an illuminating look at our centuries-long struggle to understand the nature of the physical world. It's been a long journey from the ancient belief in four elements--earth, water, fire, air--to the hundred plus elements that occupy the modern periodic table, and Ball makes a perfect tour guide, highlighting the many points of interest on the way. He introduces us to key scientists such as Lavoisier, who named oxygen, proved that water is not an element, demolished the ancient 4-elements theory, and lost his head to the guillotine. Ball highlights the unexpected opportunities for making useful things from the riches found on the periodic table. We learn, for instance, that the seemingly useless argon (after the Greek argos, 'lazy'--because it did nothing) makes perfect filler for light bulbs, because no matter how hot the bulb gets, argon won't react. Likewise, silicon, a very poor conductor of electricity (hence the label semiconductor) is perfect for computer chips, because the slow movement of electrons is easier to manipulate. Ball shows us how to read the periodic table and he recounts Mendeleev's tale of discovering the correct form to the table "in a dream." He also explains the difficulties of defining and identifying the elements, the principles behind the formation of synthetic elements, and the ways in which particular elements (gold, iron, oxygen) shaped culture and technology. From the alchemical quest for the Philosopher's Stone to the legend of the Midas touch, *The Ingredients* provides an engaging look at the elements that make up the world we live in.

## Book Information

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## Customer Reviews

The periodic table of the elements is a gallery of some of science's most intriguing characters,

according to this sprightly tome of pop-chemistry. Ball (*H<sub>2</sub>O: A Biography of Water*) traces science's understanding of the building blocks of matter as it evolved from Aristotle's four elements of earth, water, air and fire to our modern assemblage of 109 named elements with associated isotopes, some, such as hydrogen, as old as the stars and others, like an isotope of the unnamed element 111, flitting into existence for just a split second in the laboratory. Instead of giving a comprehensive treatment, Ball focuses on some of the more charismatic elements, including oxygen, an intrinsically "corrosive and destructive" substance tamed by evolution into one of the basic constituents of life; uranium and plutonium, harbingers of the nuclear age; and gold, "prized like a fashion model for its ability to look beautiful and do nothing." Along the way, he manages to lucidly and for the most part painlessly impart quite a bit of information on such topics as the structure of atoms, stellar evolution, radio-carbon dating and scientists' embarrassing infatuation with the will-o'-the-wisp of cold fusion. Non-scientists will gain from this book both a vivid impression of the dazzling variety of chemical phenomena and a sense of the order that underlies it. B&w photos. Copyright 2003 Reed Business Information, Inc.

Adult/High School-Ball's natural stylemakes a seemingly dry subject come alive. Friendly and informative, the book explores the concept of an element from a historical and practical perspective. Instead of expounding on each one, the author singles out the star players. Oxygen gets plenty ofattention, as it should since its discovery played a crucial role in breaking scientists free from the old earth-air-fire-water school of thought. Anyone who has looked at the periodic table's strange shape with bewilderment will appreciate the superb explanation as to how it got that way. Natural and artificial creation of elements is discussed, as are isotopes and radioisotopes. Mildly technical explanations get spiced up with examples, such as the Shroud of Turin and how scientists determine the age of the Earth. Finishing the story is an overview of some modern uses of various elements that includes silicon and its use in microelectronic devices. Black-and-white illustrations and photographs are included. No doubt, students could use this title for homework assignments, but its main strength is its readability. An enjoyable work that practically reads like a biography. Sheila Shoup, Fairfax County Public Library, VACopyright 2003 Reed Business Information, Inc.

Let me start by saying that this is not an "all-exhaustive" tour of every important piece of information about every element. Instead, it is several vignettes within which Ball easily wraps a discussion of many of the seminal discoveries and elements that make up our world. Most of the periodic table

can be found in the index, but a few elements (and their stories) take precedence in the narrative. Oxygen and gold in particular are devoted many pages, both in backstory and in importance to us now. In particular, the history of Lavoisier (Ball calls him, fairly appropriately, 'the Newton of chemistry') and his refutation of the Aristotelean view of four elements (which is itself the subject of the first chapter) is excellent. Gold is also provided with a chapter of its own, but after that the narrative moves more towards broader discussions. We learn about Mendeleev and the building of the periodic table into its present form (and it helps one understand \*why\* this form is so useful). We also learn about Seaborg and the hotbed of nuclear chemistry in Berkeley, California (among others) that gave us so many of the heavier elements. Ball also has a chapter on isotopes, those elements with more or fewer neutrons than 'normal' and why these (generally) less abundant siblings are so useful. They help us in medicine, dating (as in carbon dating), energy, and so much more. This book is quite short and thus is a whirlwind tour of the elements that make up the periodic table. However, since this book does not pretend to be a graduate textbook in Inorganic chemistry, I would say that it is very successful at demystifying the ingredients of our world. You will learn a bit about most of the elements, some related history to boot, and will be left with a much greater appreciation for all the neat stuff that each element's unique properties enables (as examples: the colors in your old cathode ray television, the chips in your computer, the converter your car uses to remove toxins in exhaust). Fun for a chemist, this book is even better suited to the 'layman'. I only wish the fuller narratives of the first couple chapters did not shift to what felt like a series of quick hits later in the book (in an attempt to cover as many elements as possible, I suppose).

A wonderful history of man's association with the chemical elements. Lots here on transition metals and isotopes, but it does not stop there.

There are 92 naturally occurring elements. They have been here since the Earth cooled, but only in the last couple of centuries have we truly come to understand them. In 'the ingredients', Phillip Ball takes the reader on a fast ride through the development of our understanding of the elements. Aristotle and his contemporaries saw everything pretty much as a combination of earth, wind, fire, and water. Variations of this view lasted well in the middle ages. The chapter on gold, precious from ancient times, is a bridge, bringing us into the modern age, where we see the development of the Periodic Table, an organization of information about the elements. Scientific method and technological advances allowed chemists to identify each of the elements. Physics, radiochemistry and quantum mechanics provided an explanation of why they act as they do. There are interesting

discussions of medicine, alchemy and other topics. The chapter on manmade elements is also interesting. This little book was fun to read and should be easily followed by the non-scientific reader.

Philip Ball's *The Ingredients* is a short and sweet introduction to the chemical elements. It is not a comprehensive description of each of the 110+ elements that appear on the periodic table. Rather it is a history of the concept of an element and a definition of what an element is done in context with examples. All the important terms from Chemistry 101 are there - atom, electron, element, isotope, neutron, nucleus, proton - as are all the important people and events in the history of the elements, but it is done in Ball's extremely readable prose style. Even though I've taught basic chemistry at the high school level and I've heard all this stuff before, I thoroughly enjoyed this short, but concept dense book.

Philip Ball is one of the better authors in the realm of general science literature. This short book examines the Periodic Table of Elements and how the various elements were discovered by humans, and what function they serve in nature and human society. Combining a history of discovery, with hard science about many of the elements, the book is a good, interesting, easy-to-read primer in basic chemistry and how materials science.

As-of this writing, June 2008, "The Ingredients" is in-print as an Oxford University Press Very Short Introduction titled "The Elements".

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