

Around the World in 18 Elements

This book grabbed me from the beginning. As befits its title inspired by Jules Verne, it is something of a whirlwind tour through the chemistry of 18 elements (mostly main-group elements and, in four cases, transition elements), giving not only the more mundane facts, but also some sophisticated cutting-edge information. It is the author's declared wish that the choice of elements be considered non-canonical; it comprises nine metals and nine non-metals (P, Fe, N, S, Ca, Pb, Li, I, Cu, F, Al, H, Cl, Zn, Hg, Mn, O, C). The book is not intended to replace a textbook of inorganic chemistry; rather, it is targeted at A-level students in the British system and students of equivalent background, with the intention of re-engaging them as part of a chemistry review program. As the book contains many worked problems and examples, it could also be used to advantage by first-year university students, whether majoring in chemistry or in other subjects.

Let us now take a closer look, singling out a few sub-chapters, and using the well-structured index as a guide. In the discussion of phosphorus, the unsavory process by which Hennig Brand (whose name should be spelt correctly) first discovered the element is briefly described, as is also its sinister use in firebombs. The author discusses the composition of "strike anywhere" matches, and in this context, reviews concepts such as bond enthalpy, the Hess cycle, and the writing of balanced oxidation equations. The (lesser known) phosphorus cycle is then introduced, with a quote from science (fiction) writer Isaac Asimov, and discussed; this brings the reader to appreciate the extraordinary accumulation of phosphorus in living things, as well as the subtlety that, while the phosphate ester bond-breaking in adenosine triphosphate ($\text{ATP} \rightarrow \text{ADP} + \text{P}_i$) is *endothermic*, it is the resonance stabilization energy of the resulting hydrogen phosphate ion (HPO_4^{2-}) that makes this process energetically favorable, so that ATP can work as a molecular storage of chemical energy.

This brief summary should give a first impression of how, throughout the book, the author assembles information from different fields, and makes the reader want to see how the story unfolds. The discussion of lead is introduced by listing the seven metals (including Pb) that were recognized in the alchemical tradition, and explaining why "saturnine" in English is a synonym for "gloomy and indolent". A problem that is intended to convey a feel for the smallness of atoms gives the atomic radius of Pb as 0.154 nm (but why, here and

elsewhere in the book, are parameters such as atomic radii and bond lengths given in nanometers rather than in the more usual picometers?). The chapter concludes with a well-presented review of relevant concepts in electrochemistry (lead–acid battery), radioactivity (U/Pb isotope ratios as a "clock" for dating zircon minerals), and biochemistry (lead poisoning).

At this stage, it seems in order to also mention a few shortcomings of the book in this first edition and to suggest improvements. Graphical representations of the Periodic System would be helpful, with placement of the elements as they are discussed. The copy-editing has been less than immaculate; there are annoying and recurrent confusions of terms (tetrahedral/tetrahedron; calcium instead of quicklime), spelling mistakes, bits of jargon ("identify the chiral carbon" instead of "... carbon atom"; "going across from Li to Be is decreasing the reactivity"), etc. There are also factual inaccuracies: 21, not 20, proteinogenic amino acids are encoded in eukaryotes; while magnesium and calcium have historically been summarily determined in water hardness analyses ("soap titration"), magnesium does not contribute to water hardness, as it does not form insoluble limescale. However, these are minor glitches that do not dispel the overall favorable impression of the book.

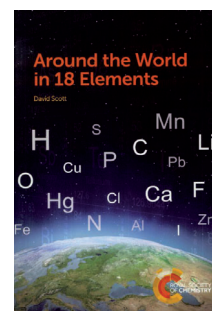
In summary, the book provides a refreshing look at chemistry from an unusual angle, i.e., by telling—with necessary brevity—stories as to how elements contribute to our complex world. While the book presents no material that could not, with some systematic searching, also be found elsewhere, it does provide, in the age of the internet and electronic media, what I would call a longitudinal cross-section through the chemistry of selected elements, from basic information to advanced applications. It integrates knowledge across chemistry disciplines (inorganic, analytical, organic, and physical chemistry), and I would recommend it not only to the target audience but also, as a "one-stop source", to educators wishing to season their course material with sometimes surprising and thought-inspiring facts. Apart from a work such as John Emsley's encyclopedic *Nature's Building Blocks*, I am not aware of a similar collection of "elemental" facts that I have read with so much enjoyment.

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