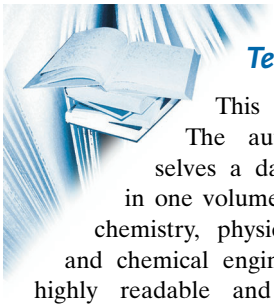
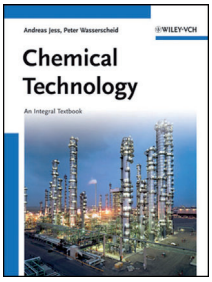


Chemical Technology



Chemical Technology
An Integral Textbook.
By Andreas Jess and Peter Wasserscheid. Wiley-VCH, Weinheim, 2013. 950 pp., hardcover, € 79.90.—ISBN 978-3527304462

This is an excellent book. The authors have set themselves a daunting task: combining in one volume the basics of industrial chemistry, physical chemistry, catalysis, and chemical engineering. The result is a highly readable and useful textbook that covers all the fundamental aspects of technical chemistry and fits well with today's curricula.

Historically, there has always been a gap between chemistry and chemical engineering. But this gap is closing. More and more companies are realizing that project success depends on integrating concepts (and teams!) early on in the project. This book meets the growing demand for inclusive courses, giving chemists more knowledge of engineering and vice versa.

The book starts with a detailed overview of units and concepts, creating a frame of references for all chapters and their examples. These 16 pages of handbook-style information are clear and concise, placing the readers on common ground. The authors then introduce the main aspects of chemical industry, showing its importance and ubiquity worldwide. Again, this is a smart way to start—the would-be engineer or chemist gets to see first the high-impact result, before being confronted with the technical equations and details. This spirit of application is kept throughout the book, with many examples, photographs, and stories.

Chapters 2, 3, and 4 cover the chemical aspects and the engineering aspects (thermal and mechanical unit operations and reactor engineering) of industrial chemistry, respectively. Starting by explaining the main types of chemical reactions, the authors then move on to catalysis and its importance in industrial processes. The examples are well chosen, with emphasis on importance by volume and market. The engineering sections are detailed, covering thoroughly the subjects of chemical thermodynamics, kinetics of homogeneous and heterogeneous reactions, and the different types of reactors. All these assume a working knowledge of calculus and algebra, so the book is suitable for senior undergraduate students and up.

There are some dry and technical bits, sure, but the authors' commitment to keeping their readers interested shines through. One highly effective device that they use well is embedding biographies of key scientists in the text, often with anecdotal tidbits that stick in the readers' memory. I am very much in favor of this approach, that I find also highly effective from my own teaching experience. One of the challenges in teaching is to encourage students to remember the course content beyond the exam date. Research on memory shows that information retrieval in our brain does not depend on a grid-box system (there is simply not enough space to keep all the information pieces in separate boxes). Rather, memory events are triggered and memories are reconstructed when the triggering occurs (you can read more on this in Kevin Kelly's fascinating *Out of Control*). I found that students are more likely to remember details of an alkylation process when they're told that the Battle of Britain was won by the side who had the better alkylation catalysts, and therefore higher-quality airplane fuel. Similarly, reading on p. 201 that the Swedish chemist Svante August Arrhenius, who nearly failed his doctorate exam in 1884, received the Nobel Prize for the same work 19 years later does more than bring a smile to the readers' faces. It actually embeds in their memories a trigger to the Arrhenius' equation and its importance as an empirical indicator of kinetic barriers.

The book's second half is devoted to examples, case studies, and applications. Chapter 5 is a real gem, discussing in just 50 pages the current status of raw materials, environmental aspects, and economic aspects of chemical technology. The information is well balanced and well presented. This is such an important chapter, that teachers should consider placing it at the beginning of the course (it can easily be taught as a separate section or as part of another course). Subsequently, the authors cover in chapter 6 no less than 20 industrial examples, starting from the classic largest processes (ammonia synthesis, syn-gas, sulfuric acid) followed by refinery examples (steam cracking, hydrotreating, alkylation), polymer examples, and all the way to fine chemicals (menthol).

The authors' experience as teachers is visible. Didactic devices such as 'repetition and example' are well used. In the discussion on determining the theoretical stages of a distillation column, for example, they show three different versions of the vapor/liquid equilibrium graph (pp. 104–105): one general, one explanatory, and one with the specific data for water/methanol. This is then combined with a schematic and a photograph, so the reader cannot fail to get the message.

The printing format chosen by the authors (and their editors) brings additional advantages. Pages have extra-wide margins, inviting the reader to jot down notes or stick post-its. All the diagrams and photos are cleanly presented, and much attention is given to clear and unambiguous graphs and schematics. Every so often, the margin is used for attracting attention to an example or a sideline story, again increasing the book's readability.

There are several other good textbooks that target one or more of the specific subjects covered here, focusing on *Industrial Organic Chemistry* (Arpe), *Physical Chemistry* (Moore, Atkins), *Reactor Engineering* (Levenspiel, Fogler) or *Catalysis*

(ahem, … Rothenberg), but this is the first well-written and clearly presented comprehensive textbook on modern chemical technology.

In summary, this book is timely, useful, well thought out and well presented. It contains lots of useful knowledge. I highly recommend it to teachers of chemical technology, to senior undergraduates and graduate students in chemistry who are interested in the industrial aspects of their profession, and of course to chemical engineers.

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