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***modern approach to applied  
thermodynamics. The  
material is presented in  
sufficient detail to provide a  
solid understanding of the  
principles of  
thermodynamics and its***

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***classical applications. Also  
included are the  
applications of chemical  
engineering  
thermodynamics to issues  
such as the distribution of  
chemicals in the***

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***environment, safety,  
polymers, and solid-state-  
processing. To make  
thermodynamics more  
accessible, several helpful  
features are included.  
Important concepts are***

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***emphasized in marginal  
notes throughout each  
chapter. Illustrations have  
also been added to  
demonstrate the use of  
these concepts and to  
provide a better***

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***understanding of the  
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***additional problem sets,  
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***This book develops the  
theory of chemical  
thermodynamics from first  
principles, demonstrates its***

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***relevance across scientific  
and engineering disciplines,  
and shows how  
thermodynamics can be  
used as a practical tool for  
understanding natural  
phenomena and developing***

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***and improving technologies  
and products. Concepts  
such as internal energy,  
enthalpy, entropy, and  
Gibbs energy are explained  
using ideas and experiences  
familiar to students, and***

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***realistic examples are given  
so the usefulness and  
pervasiveness of  
thermodynamics becomes  
apparent. The worked  
examples illustrate key  
ideas and demonstrate***

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***important types of calculations, and the problems at the end of chapters are designed to reinforce important concepts and show the broad range of applications.***

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***Most can be solved using  
digitized data from open  
access databases and a  
spreadsheet. Answers are  
provided for the numerical  
problems. A particular  
theme of the book is the***

***calculation of the  
equilibrium composition of  
systems, both reactive and  
non-reactive, and this  
includes the principles of  
Gibbs energy minimization.  
The overall approach leads***

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***to the intelligent use of  
thermodynamic software  
packages but, while these  
are discussed and their use  
demonstrated, they are not  
the focus of the book, the  
aim being to provide the***



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***necessary foundations.***

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the inclusion of three  
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and energy aspects of  
processing; the  
thermodynamics of metal***

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***production and recycling;  
and applications of  
electrochemistry. This book  
is aimed primarily at  
students of chemistry,  
chemical engineering,  
applied science, materials***

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students are also  
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thermodynamics of DNA,  
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***they make a complete  
reference set for the practicing  
scientist. This volume extends  
the range of topics and  
applications to ones that are  
not usually covered in a  
beginning thermodynamics***

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***text. In a sense, the book covers a "middle ground" between the basic principles developed in a beginning thermodynamics textbook, and the very specialized applications that are a part of***

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***an ongoing research project.  
As such, it could prove  
invaluable to the practicing  
scientist who needs to apply  
thermodynamic relationships  
to aid in the understanding of  
the chemical process under***

***consideration. The writing style in this volume remains informal, but more technical than in Principles and Applications. It starts with Chapter 11, which summarizes the thermodynamic***

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***relationships developed in this  
earlier volume. For those who  
want or need more detail,  
references are given to the  
sections in Principles and  
Applications where one could  
go to learn more about the***

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***development, limitations, and conditions where these equations apply. This is the only place where Advanced Applications ties back to the previous volume. Chapter 11 can serve as a review of the***

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***fundamental thermodynamic equations that are necessary for the more sophisticated applications described in the remainder of this book. This may be all that is necessary for the practicing scientist***



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***who has been away from the field for some time and needs some review. The remainder of this book applies thermodynamics to the description of a variety of problems. The topics covered***

***are those that are probably of the most fundamental and broadest interest. Throughout the book, examples of "real" systems are used as much as possible. This is in contrast to many books where "generic"***

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***examples are used almost exclusively. A complete set of references to all sources of data and to supplementary reading sources is included. Problems are given at the end of each chapter. This makes***

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as a textbook in an advanced  
topics course in chemical  
thermodynamics. An excellent  
review of thermodynamic  
principles and mathematical  
relationships along with***

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***references to the relevant  
sections in Principles and  
Applications where these  
equations are developed  
Applications of  
thermodynamics in a wide  
variety of chemical processes,***

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***including phase equilibria,  
chemical equilibrium,  
properties of mixtures, and  
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*a complex matrix  
consisting of different  
groups of compounds  
divided into  
macronutrients (lipids,  
carbohydrates, and  
proteins), and*



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*micronutrients (vitamins,  
minerals, and  
phytochemicals). The  
quality characteristics of  
food products associated  
with the sensorial,  
physical and*

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*microbiological attributes  
are directly related to  
the thermodynamic  
properties of specific  
compounds and complexes  
that are formed during  
processing or by the*

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*action of diverse interventions, such as the environment, biochemical reactions, and others. In addition, in obtaining bioactive substances using separation processes, the*

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*knowledge of phase equilibria of food systems is essential to provide an efficient separation, with a low cost in the process and high selectivity in the recovery of the*

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*desired component. This book combines theory and application of phase equilibria data of systems containing food compounds to help food engineers and researchers to solve*

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*complex problems found in  
food processing. It  
provides support to  
researchers from academia  
and industry to better  
understand the behavior of  
food materials in the face*

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*of processing effects, and  
to develop ways to improve  
the quality of the food  
products. Presents the  
fundamentals of phase  
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the difficult concept and  
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*the 2nd Law of*

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*approach and offering*

*qualitative discussions of*

*the role of molecular*

*interactions, Koretsky*

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advanced concepts.*

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of the text "Bioreaction  
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Jens Nielsen and John  
Villadsen, originally*

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*published in 1994 by  
Plenum Press (now part of  
Kluwer). Time runs fast in  
Biotechnology, and when  
Kluwer Plenum stopped  
reprinting the first  
edition and asked us to*



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*make a second, revised  
edition we happily  
accepted. A text on  
bioreactions written in  
the early 1990's will not  
reflect the enormous  
development of*

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*experimental as well as  
theoretical aspects of  
cellular reactions during  
the past decade. In the  
preface to the first  
edition we admitted to be  
newcomers in the field.*

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*One of us (JV) has had 10 more years of job training in biotechnology, and the younger author (IN) has now received international recognition for his work with the hottest topics of*

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*"modern" biotechnology.*

*Furthermore we are happy  
to have induced Gunnar  
Liden, professor of  
chemical reaction  
engineering at our sister  
university in Lund, Sweden*

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to join us as co-author of  
the second edition. His  
contribution, especially  
on the chemical  
engineering aspects of  
"real" bioreactors has  
been of the greatest

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*value. Chapter 8 of the present edition is largely unchanged from the first edition. We wish to thank professor Martin Hjortso from LSU for his substantial help with this*

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constant temperature and constant  
pressure; biochemical reactions are*

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*equations that represent  
thermodynamic properties as a  
function of independent variables  
become more complicated. This  
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Reactions describes how researchers*

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gives comprehensive coverage of*

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branches such as polymer  
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Chapter 8 to highlight the*



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