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IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

Vice Rectorate for Graduate Studies and Scientific Research
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INTERACTIVE PHYSICAL CHEMISTRY

First Edition - 2017

College of Sciences,
King Fahd University of Petroleum & Minerals
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Introduction

Physical chemistry is an enjoyable subject that is needed in all other branches of chemistry and closely linked to other areas of natural science such as physics, geology and biology. Additionally, through the study of physical chemistry students can link what they have learnt in mathematics, physics and chemistry in a coordinated and integrated manner.

In writing this book the authors drew from their long experience in teaching physical chemistry courses including advanced courses in spectroscopy, chemical kinetics and thermodynamics. The authors based the book on two convictions.
The first is the belief that the student needs to fully grasp a scientific concept or model prior to applying it by carrying out calculations based on equations resulting from it which in turn need to be tested for correctness. The second is the importance of plotting relations between variables to promote the understanding of equations resulting from models and/or to check how closely experiment agrees with theory.

The book covers most of the topics taught in undergraduate physical chemistry courses. It is in eleven units. Depending on the topic a unit may be further divided into modules. There are a total of thirty-nine modules. One or more Matlab 7.0 interactive programs are used in each module. The total number of interactive programs is eighty-seven.

The learning objectives are listed at the beginning of each module.
These are followed by a brief survey of the background to the topic of the module and instructions on how to run the interactive program related to it.

This is followed by an illustration of the calculations relevant to the topic at hand to assist the student to carry out similar calculations. At the end of the module the student is required to answer and/or discuss questions on the topic.

The student is expected to utilize the information given in the background to a topic when running the program relevant to it. Nevertheless the authors recommend that the student first look at results from data already stored in the program. Once reassured of his/her understanding of what is required the student can enter the appropriate values into the program and perform the computations.

Default values can be reactivated by simply pressing the Reset button. In some programs the student is not required to enter any values and he/she is expected to perform computations on values changed randomly by the program.

A student may use a program on his/her own repeatedly to ensure his/her understanding of the concept involved. Additionally the instructor may show the program on a screen and explain how it works then ask the students to run it and submit their calculations and results for evaluations. The instructor can ask the students to discuss the results and thereby promote knowledge building and critical thinking.

Based on the preceding remarks it can be seen that the book may be used to teach physical chemistry or to supplement a physical chemi try textbook. It can also be used to teach part of a laboratory course.

The following points summarize the features that distinguish this book from other physical chemistry textbooks.

1. Each subunit consists of a list of teaching objectives, a summary of the background to the topic, a set of instructions for running one or more interactive programs, and an illustration of the calculation involved and provides an opportunity for discussing the results.
2. In all programs the results are presented as plots of mathematical relations.
3. The design of the interactive programs is such that the data needed for running them is either randomly selected or entered by the student. This allows an infinite number of examples that vary from one student to another and require each student to carry out the computations required from him/her on his/her own.
4. Some programs simulate real life laboratory experiments which facilitate a better understanding of the topic at hand.
5. Utilization of the potentials of the Matlab 7.0 programs which include printing the results, enlargement and rotation of figures, showing values on curves and so on.

The authors believe that the methodology adopted in this book is unique as it combines a scientific idea with its application in an invigorative and interactive manner that eliminates boredom.

The authors thank King Fahd University of Petroleum and Minerals for its continued support of its faculty. The authors also thank Dammam University for its support and encouragement.

Special thanks go to Prof. Mohammad Al-Homoud, the Dean of Scientific Research at KFUPM for encouraging the authors to write an Arabic version of this book.

The authors also thank Safiyyah Abdelaziz Al-Suwaiyyn, Zeinab Abdelaziz Al-Suwaiyyn and Fatimah Abdelaziz Al-Suwaiyyn for their effort in revising the book for typographical errors.

We ask God almighty that this book be a qualitative addition to other books on the subject.

The Authors

Absract

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