Textbook and Solutions Manual

Analytical Chemistry 2.1 is an open-access, digital textbook and accompanying solutions manual for undergraduate courses in analytical chemistry, released under a Creative Commons BY-NC-SA license and available in PDF format at no cost to faculty and students.

The topics covered in Analytical Chemistry 2.1 (see TOC on right) include those common to introductory, undergraduate courses in analytical chemistry with an additional emphasis on topics such as sampling and method development.

The textbook’s art work includes illustrations and photographs, all in color, which are available separately either as .png or as editable .ai files.

Examples of some of the textbook’s features are highlighted in this panel.

Case Study 1: The first case study introduces method development in the context of the analysis of several pharmaceutically important components in a medicinal plant, and is based on results published in the literature as “Simultaneous extraction of hydroxylated phenolic acids and lipophilic tannins from Salvia miltiorrhiza radix by an optimized microwave-assisted extraction method,” the full reference for which is Fang, X.; Wang, J.; Zhang, S.; Zhao, Q.; Zheng, Z.; and Song, X. Sep. Purif. Technol. 2012, 86, 149-156. The topics covered in the module (see below left) include selecting a mobile phase and an analytical wavelength, optimizing the experimental conditions for extracting the analyte, and evaluating the method’s accuracy. A typical example of an investigation in its web-based format (see below right) includes data in the form of a chromatogram that students can manipulate to find retention times and peak heights.

Case Study 2: The second case study introduces students to ways of thinking about and working with data using, as an example, the analysis of 1.69-oz packages of plain M&Ms.

Contextual Case Studies

New to this edition of Analytical Chemistry 2.1 are contextual case studies that illustrate topics covered in the textbook. Each case study is available in two formats: a text file that faculty can use as is or modify to meet local needs, and a web-based version that allows students to interact with the case study’s data using figures created with Plotly (https://plotly.com/). Each case study includes an Instructor’s Guide, which provides additional background information and suggested responses to the case study’s investigations. Two case studies are complete and are highlighted below; additional case studies are in development.

R Functions, Packages, and Shiny Apps

Also new to this edition of Analytical Chemistry 2.1 are materials developed for use in the R programming environment (https://www.r-project.org/), including functions and packages for generating figures and for simulating data, and learning modules built using the R Shiny package (http://shiny.rstudio.com/).

The R package titrationCurves includes functions for acid-base, redox, complexation, and precipitation titrations. Additional functions and packages are planned for visualizing topics in the statistical analysis of data, the optimization of experiments, and in equilibrium chemistry, and for generating data sets, to name a few.

Also under development are interactive learning modules, such as the one illustrated below. These learning modules are built using the Shiny package and run locally on a computer with R installed or from a remote server (http://www.shinyapps.io/). Additional Shiny Apps are in development to explore topics such as the central limit theorem, sampling, and signal processing, to name a few.

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Inspiration: participants in summer curriculum workshops sponsored by the Analytical Sciences Digital Library (ASDL) visit http://bit.ly/1QeZ5m8 to review other materials.