Workbook to accompany

SAUNDERS

INTERACTIVE GENERAL CHEMISTRY CD-ROM
Version 2.5 with ActivChemistry™

John C. Kotz
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with ActivChemistry™ lessons
Fermann and Jimmy Reeves

Workbobk
to Accompany
Saunders Interactive
General Chemistry
CD-ROM

Version 2.5 with ActivChemistry™

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Saunders College Publishing

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Introduction to the Saunders General Chemistry CD-ROM

The *Saunders General Chemistry CD-ROM* for Macintosh and Windows is an interactive presentation of general chemistry for college and university students embarking on careers in the sciences and health professions. Our goals in producing the CD-ROM are

- to emphasize the concepts of chemistry.
- to illustrate the images and sounds of chemistry.
- to illustrate the connection between the macroscopic world and the submicroscopic world of atoms and molecules.
- to provide some important tools for learning and doing chemistry.

We want students to view the world as chemists do, that is, to think about molecules. We also want students to gain a feel for the way data and observations are used to generate concepts, in particular the concepts usually presented in general chemistry.

The focus of the discs is an *Interactive Presentation* of general chemistry. The presentation is based on the introductory chapter and the first 21 numbered chapters (of 24 chapters) in *Chemistry & Chemical Reactivity*, 3rd edition, by John C. Kotz and Paul M. Treichel. The discs and this *Workbook* are intended to be used with this book, with the 4th edition of *Chemistry & Chemical Reactivity*, or with any other general chemistry text. The discs and *Workbook* could also be used alone and, as such, constitute nearly an entire chemistry course.

The core of Version 2.5 of the CD-ROM is identical to Versions 2.0 and 2.1. No significant alterations have been made in the material. However, *ActivChemistry* has been added. This software package, which allows the student to design and perform simulated laboratory experiments in chemistry, has been integrated into the screens of the previous version.

The CD-ROM can also be used with the 4th edition of *Chemistry & Chemical Reactivity*. The new edition largely follows the organization of the 3rd edition, with the exception of a rearrangement of topics in Chapters 2-5. Icons in the margin of the 4th edition correlate the book with the CD-ROM.

FEATURES OF THE CD-ROM

While the *Interactive Presentation* makes up the majority of the material on these discs, other items are

- ActivChemistry™ Software
- CAChe Visualizer for Education, a tool for visualizing molecules and their properties
- Interactive periodic table database
- Database of Common Chemical Compounds
- Plotting tool
- Molecular weight and molarity calculators

Each is described briefly below with reference to the location of more detailed instructions for its use.

Interactive Presentation

Information is presented as "screens" within chapters, the organization of which follow *Chemistry & Chemical Reactivity*. Each screen in each chapter is meant to introduce a key concept in that chapter. The ideas that stem from that concept are then presented in sidebars such as "A Closer Look" screen, a problem screen, a biography of a scientist, or an environmental note. Complete instructions for using this presentation are in the section of this *Workbook* titled *Using the CD-ROM* and in the instructions that accompany the discs.

CAChe Visualizer for Education

CAChe Scientific/Oxford Molecular has licensed the *CAChe Visualizer for Education*, a tool for viewing and manipulating molecules. All of the molecules featured in *Chemistry & Chemical Reactivity*, 4th edition, are included on the CD-ROM plus many others. The user can view these molecules and crystal structures and measure bond distances and bond angles. In addition, energy maps, molecular orbitals, and electron density surfaces can be visualized. In the Macintosh version it is possible to view calculated infrared spectra. Brief instructions for using the software are in Appendix A of the *Workbook*.

Interactive Periodic Table

The *Interactive Periodic Table* includes a database of 18 element properties, a tool to view three-dimensional representations of periodic trends, definitions of terms, and an interactive tool that gives the electron configuration of any element. The database is found by clicking on the "Tools" button in the *Interactive Presentation*.

Database of Chemical Compounds

Over 80 compounds are contained in a database that can be searched by name. Information available includes a model of the molecule or crystal lattice, its common and systematic name, density, melting point and boiling point, thermodynamic data, and, for weak acids and bases, ionization constants. Models of virtually all these molecules are included in the files that accompany the *CAChe Visualizer for Education*.

Plotting Tool

A general purpose plotting program is included that allows plotting and manipulation of x-y type data. It allows students to do a least-squares analysis of data and will return a slope, intercept, and correlation coefficient. Directions for using the tool are in Appendix A of this *Workbook*.

Molecular Weight and Molarity Calculators

These programs allow the user to calculate quickly the molecular weight of any compound and to calculate the quantity of a compound required to prepare a certain volume of a solution with a given concentration. They are located in the "Tools" button in the *Interactive Presentation*.

Important Tables

For your reference, some important tables of information in the *Interactive Presentation* are

Screen	Table Title
6.17	Enthalpies of Formation
8.10	Atomic Size
8.11	Ion Sizes
8.12	Ionization Energy
8.13	Electron Affinity
9.9	Bond Length
9.9	Bond Energies
9.11	Electronegativity
17.6	Weak Acids and Bases
19.4	Solubility Products
21.6	Standard Potentials

WORKBOOK

The *Workbook* is organized around the main "concept" screens, each of which is numbered by the chapter and screen. The questions in the *Workbook* can be answered after reading the text on the screen (and related screens), observing the videos, photos, and animations, and working through associated problems.

The *Workbook* questions are often not the usual questions found in a textbook. Instead, they ask you to make observations from videos or animations of reactions and draw conclusions from those observations. Or, you may be asked to derive data from your observations, treat those data using a mathematical tool, and then draw conclusions from the outcome. Other questions ask you to observe molecules using the *CAChe Visualizer for Education* and to use those models to derive your own understanding of relevant chemical phenomena. Still another possibility is to use one of the "interactive tools." An example is the one on Coulomb's law (Chapter 3), where you can vary the charge on two ions and the distance between them to better understand the consequences of chemical bonding involving ions. Finally, you may be asked to search the chemical databases to find data on elements and then to find the relationships among those data.

Because the CD-ROM presentation cannot include some of the details of problem solving that are given in the usual textbook, the questions for each screen in the CD-ROM also include appropriate Exercises; Study Questions are found at the end of each chapter. (All are taken from *Chemistry & Chemical Reactivity*; answers to these questions are found in Appendices B and C, respectively, of this *Workbook*.)

ACKNOWLEDGEMENTS

FINALLY ...

Using the CD-ROM

The *Saunders Interactive General Chemistry CD-ROM* is a complete multimedia presentation of college-level introductory chemistry. The presentation follows the structure of the Saunders College Publishing textbook *Chemistry & Chemical Reactivity*, 3rd and 4th editions, by Kotz and Treichel.

The two-disc set includes

- The Interactive Presentation, with the Introduction and Chapters 1-9 on Disc 1, and Chapters 10-21 on Disc 2.
- ActivChemistry™ Software and 52 lessons coordinated with each chapter.
- Database of Chemical Compounds
- CACHe™ Visualizer for education (molecular modeling software) and library of molecular models.
- Tool for plotting graphs
- Interactive Periodic Table

MINIMUM SYSTEM REQUIREMENTS

Windows™ installation requires:

Computer/OS:
  MPC Level II compliant computer
  486DX-66 computer running Windows 3.1 or greater
  (note: ActivChemistry will not run on Windows NT)

RAM: 8 megabytes for Windows 3.1, 16 megabytes for Windows 95 or NT

Hard Disk Space: 15 MB

Other:

  256 color capable VGA video board that is MPC Level II compliant, and
    a color VGA display (minimum)
  SoundBlaster(TM) compatible audio card, and speakers or a headset
  Double speed CD-ROM drive (minimum)
  Mouse

Macintosh installation requires:

Computer/OS:
  Macintosh, 68020 or greater, Power Mac (Acrobat Reader) running
    Mac OS 7.1 or greater

RAM: 16 MB

Hard Disk Space: 20 MB

Other:
  256-color display monitor at 640 x 480 pixels (minimum)
  Double speed CD-ROM drive (minimum)
  QuickTime™ version 2.1 software
  Mouse

Running the CAChe Visualizer for Education or ActivChemistry software
requires a Floating-Point-Unit (FPU)

INSTALLATION INSTRUCTIONS
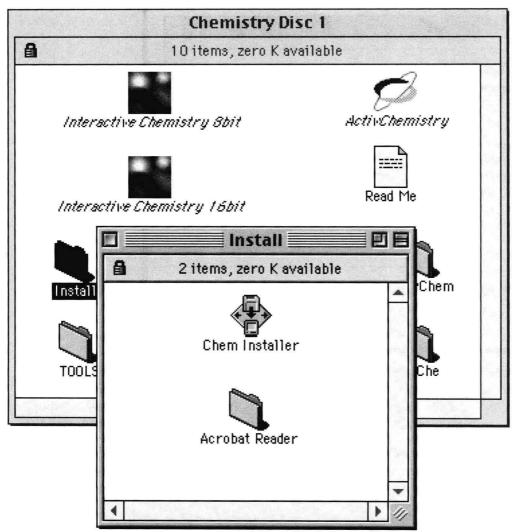
Installation can be performed from either disc in the two-disc set. Only one installation is needed. Each disc contains both Macintosh and Windows versions of the presentation.

Installation Procedure for the Macintosh

Put either disc in the CD-ROM drive and double-click the Chemistry Disc icon on the desktop to open the CD-ROM window.

Chemistry Disc 1

In the CD-ROM window, open the Folder named *Install* by double-clicking on it.
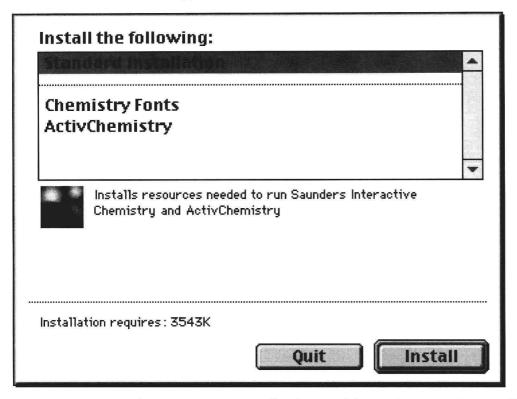
Double-click on the *Chem Installer* icon.

Chem Installer

The installer start-up screen opens. Click *"Continue."*

The End-User License Agreement screen appears. Please read the agreement carefully. If you do not agree with the terms of the license agreement, click *"Disagree"* and return the CD-ROM to Saunders College Publishing for a full refund. If you agree, click *"Agree."*

The installation window appears with the "Standard Installation" option pre-selected.

Note: Interactive Chemistry uses specially designed fonts that must be installed for the application to run properly. In addition, it requires that you have QuickTime version 2.1 or greater already installed on your computer. (QuickTime™ is Apple Computer's programming "architecture" for motion pictures, and it comes pre-installed with most Apple computers.)

Click the *"Install"* button. The fonts will be placed in the Fonts folder, and ActivChemistry resources will be placed in the Extensions folder, both of which are in your System folder. If you wish to install only the Chemistry Fonts or ActivChemistry, select the appropriate option and click *"Install."*

A message appears telling you that installation was successful. Click *"Quit."*

Several files on the CD-ROM require the installation of a separate application, the Adobe™ Acrobat™ Reader, to view the files properly. These files include:

- the Interactive General Chemistry CD-ROM workbook file, which is found in the workbook folder, on the desktop (top level of the CD-ROM).
- the ActivChemistry User's Guide, the list of image sources for the CD-ROM, and a compilation of the tables found in the CD-ROM. All these files are found in the DOCS folder on the desktop.
- correlation guides that correlate the screens of the CD-ROM to five of Saunders's most popular chemistry textbooks. These files are found in the COR_GUID folder that is found in the DOCS folder on the desktop.
- instructions for use and indexes for the CACHe molecular models found on the CD. These files are found in the DOCS folder that is located in the CACHe folder on the desktop.
- a database of chemical compounds, found in the Tools folder on the desktop.

To install this program, open the Acrobat Reader folder, double-click on Reader 3.01 Installer, and follow the directions.

Reader 3.01 Installer

Following successful installation of the Acrobat software, you will be prompted to restart your computer so it can recognize the new additions to your System folder. If you wish to run the presentation immediately, choose "Restart."

Installation is now complete.

To run the Interactive Chemistry presentation, one of the discs must be in the CD-ROM drive.

Choose *Interactive Chemistry 8bit* if you are running the program on a computer whose monitor is set to 8-bit (256-color) resolution.

Interactive Chemistry 8bit

Choose *Interactive Chemistry 16bit* if you are running the program on a computer whose monitor is set to 16-bit (thousands of colors) or higher resolution.

Interactive Chemistry 16bit

Note: Your Macintosh will display the following message if you attempt to run the 16-bit program on a monitor with 8-bit resolution.

This application needs a thousands of colors monitor with at least 640x480 pixels!

OK

INSTALLATION PROCEDURE FOR WINDOWS

From within Windows™ 3.1

Put either disc in the CD-ROM drive.

In the Program Manager window, select Run from the file menu.

Type "D:\setup.exe" and choose OK.

Note: If your CD-ROM drive is not accessed through the drive letter "D," then substitute the appropriate letter in the setup command.

Follow the steps listed under General Windows Installation Procedures below.

From within Windows™ 95

Put either disc in the CD-ROM drive.

Double-click on the "Shortcut to CD-ROM Disc" icon, or open "My Computer" and double-click on the CD-ROM icon.

Double-click on the "Setup" icon.

In the dialog box, click "Full - Install all files."

The next dialog box asks if you want setup to create Program Manager groups. Click *"Yes."*

The third dialog box asks if you would like the installer to add lines to AUTOEXEC.BAT. Click *"Yes."*

The last dialog box indicates that to complete installation, you should run the QTW and Acrobat installers. Click *"OK."*

To finish installation, follow the General Windows Installation Procedures below.

General Windows Installation Procedures

In the new Program Manager group, double-click on Install QTW and follow the installation instructions that appear in the dialog boxes.

When QuickTime has finished installing, close the QuickTime for Windows Program Manager group to return to the Saunders Chemistry 2.5 Program Manager group.

Several files on the CD-ROM require the installation of a separate application, the Adobe™ Acrobat™ Reader, to view the files properly. These files include:

- the Interactive General Chemistry CD-ROM workbook file, which is found on the top level of the CD-ROM.
- the ActivChemistry User's Guide, the list of image sources for the CD-ROM, a database of chemical compounds, and a compilation of the tables found in the CD-ROM. All these files are found in the DOCS folder on the desktop.

- correlation guides that correlate the screens of the CD-ROM to five of Saunders's most popular chemistry textbooks. These files are found in the COR_GUID folder that is found in the DOCS folder on the desktop.
- instructions for use and indexes for the CACHe molecular models found on the CD. These files are found in the DOCS folder that is located in the CACHe folder on the desktop.
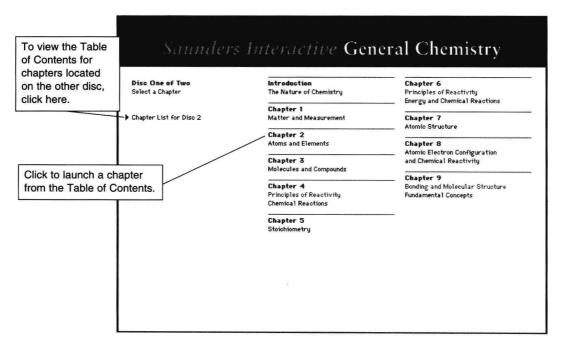
There are two options available for installing Acrobat Reader: 16 bit (for those running Windows 3.x) and 32 bit (for those running Windows 95). Double-click on the version that matches your computer's operating system and follow the instructions in the dialog boxes that appear.

STARTING THE PRESENTATION

Chemistry Disc1

Once the program is properly installed and the desired disc is in the CD-ROM drive, open the CD-ROM by clicking on its icon.

Interactive Chemistry

To begin the presentation, double-click on the Interactive Chemistry icon.

A Table of Contents appears. The presentation is divided into chapters, with the Introduction and Chapters 1–9 on Disc 1 and Chapters 10–21 on Disc 2.

To view the Table of Contents for chapters located on the other disc, click here.

Click to launch a chapter from the Table of Contents.

Saunders Interactive General Chemistry

Disc One of Two
Select a Chapter

▶ Chapter List for Disc 2

Introduction
The Nature of Chemistry

Chapter 1
Matter and Measurement

Chapter 2
Atoms and Elements

Chapter 3
Molecules and Compounds

Chapter 4
Principles of Reactivity
Chemical Reactions

Chapter 5
Stoichiometry

Chapter 6
Principles of Reactivity
Energy and Chemical Reactions

Chapter 7
Atomic Structure

Chapter 8
Atomic Electron Configuration
and Chemical Reactivity

Chapter 9
Bonding and Molecular Structure
Fundamental Concepts

Notes

The mouse is used for all navigation. A pointing finger cursor 👆 indicates an active, clickable area. Inactive screen areas are indicated by the arrow cursor ➤ . Navigation within the presentation is accomplished by a single click of the mouse.

Notes
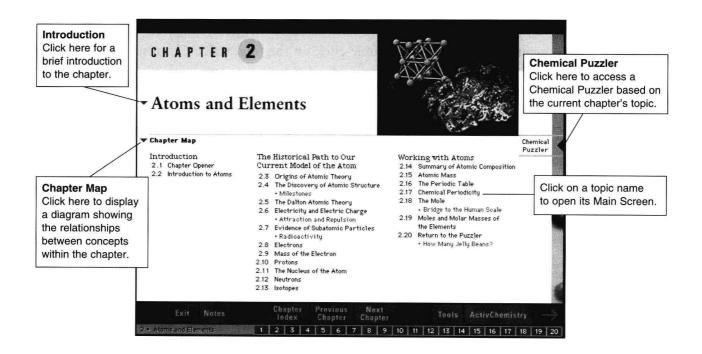
Each chapter exists as a separate application. When you change chapters, the chapter in use closes and the selected chapter opens.

USING THE PRESENTATION
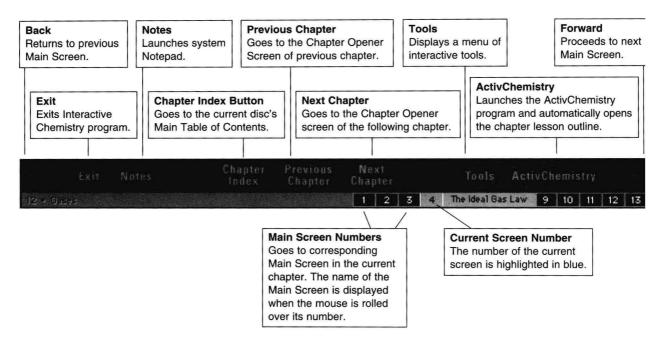
Chapter Opener

The first screen of every chapter (except in the Introductory chapter) is a Chapter Opener.

Each chapter is organized into a series of Main Screens, which address a single topic or a group of closely related topics. The Chapter Opener screen provides a list of that chapter's Main Screens.

In addition to a Table of Contents, each Chapter Opener screen includes an Introduction, Chapter Map, and Chemical Puzzler, all indicated by red arrows.

Introduction
Click here for a brief introduction to the chapter.

Chapter Map
Click here to display a diagram showing the relationships between concepts within the chapter.

Chemical Puzzler
Click here to access a Chemical Puzzler based on the current chapter's topic.

Click on a topic name to open its Main Screen.

CHAPTER **2**

Atoms and Elements

▼ **Chapter Map**

Chemical Puzzler

Introduction
2.1 Chapter Opener
2.2 Introduction to Atoms

The Historical Path to Our Current Model of the Atom
2.3 Origins of Atomic Theory
2.4 The Discovery of Atomic Structure
    • Milestones
2.5 The Dalton Atomic Theory
2.6 Electricity and Electric Charge
    • Attraction and Repulsion
2.7 Evidence of Subatomic Particles
    • Radioactivity
2.8 Electrons
2.9 Mass of the Electron
2.10 Protons
2.11 The Nucleus of the Atom
2.12 Neutrons
2.13 Isotopes

Working with Atoms
2.14 Summary of Atomic Composition
2.15 Atomic Mass
2.16 The Periodic Table
2.17 Chemical Periodicity
2.18 The Mole
    • Bridge to the Human Scale
2.19 Moles and Molar Masses of the Elements
2.20 Return to the Puzzler
    • How Many Jelly Beans?

Exit   Notes   Chapter   Previous   Next   Tools   ActivChemistry
                     Index   Chapter   Chapter

2 • Atoms and Elements   1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20

Navigation Bar Operation

Back
Returns to previous Main Screen.

Notes
Launches system Notepad.

Previous Chapter
Goes to the Chapter Opener Screen of previous chapter.

Tools
Displays a menu of interactive tools.

Forward
Proceeds to next Main Screen.

Exit
Exits Interactive Chemistry program.

Chapter Index Button
Goes to the current disc's Main Table of Contents.

Next Chapter
Goes to the Chapter Opener screen of the following chapter.

ActivChemistry
Launches the ActivChemistry program and automatically opens the chapter lesson outline.

Exit   Notes   Chapter Index   Previous Chapter   Next Chapter   Tools   ActivChemistry

12 - Gases | 1 | 2 | 3 | 4 | The Ideal Gas Law | 9 | 10 | 11 | 12 | 13 |

Main Screen Numbers
Goes to corresponding Main Screen in the current chapter. The name of the Main Screen is displayed when the mouse is rolled over its number.

Current Screen Number
The number of the current screen is highlighted in blue.

At the bottom of the screen is the navigation bar. It is used to move between screens and chapters, to access additional features, and to exit the program. The navigation bar also provides access to interactive tools, ActivChemistry, and the notebook.

Main Screens

Main Screens are accessed either from the Table of Contents on the Chapter Opener Screen or from the Navigation Bar at the bottom of each screen in a chapter. Each Main Screen includes several features such as video or audio clips, problems, sidebars, tables, or animated simulation that provide more information about the current topic. Most features can be accessed and navigated by clicking on their corresponding red arrows.

Molecular Fluxionality

Bond Rotations

Molecules experience a number of motions. Some involve the entire molecule, such as translations, vibrations, and rotations. Others, called fluxional motions, involve changes in the shape of the molecule, such as rotations about a bond. In rotations about a bond, one part of a molecule pivots with respect to another. The energy required to cause such a rotation is called the bond rotation energy. Rotations about multiple bonds are accompanied by large energy barriers and do not take place readily, whereas those about single bonds are accompanied by smaller energy barriers and occur more easily.

trans-2-butene

233.11

26.92

Energy (kJ/mol)

Angle of Rotation

butane

78.49

20.43

Energy (kJ/mol)

Angle of Rotation

Call-out
Click underlined words to access a definition or explanation.

Exit Notes Chapter Index Next Chapter Tools ActivChemistry

10 • Orbital Hybridization 1 2 3 4 5 6 7 3 9 10 11 12 13 14 15 16

Video Controller
Push the Play/Pause button to see the video with narration. Slide the controller to move forward or backward through the clip.

Oxidation Numbers

Video Window

Problem
→ ? →

Problem
Click to access a problem related to the current topic.

Play/Pause Button
Click to play, stop, or pause a narrated video clip or animation.

Oxidation numbers are used to describe redox reactions. Consider the reaction of NO and O_2.

$$2\,NO(g) + O_2(g) \rightarrow 2\,NO_2(g)$$

Because nitrogen monoxide has no net charge and oxygen in this compound has the oxidation number −2, the nitrogen in the NO is assigned the number +2; the sum of the oxidation numbers for O and N must add up to 0 to be a neutral species. In the product NO_2, the oxidation number for N is +4, increased to balance the additional oxygen atom's −2. Because the oxidation number of N increases in the reaction, NO is said to be oxidized. Meanwhile, the oxidation number of the O atoms in the pure O_2 decreases from 0 to −2, indicating that O is reduced.

A Closer Look

Disproportionation Reactions

Sidebar
Click to access a related topic.

Click red arrows to access more information or to initiate an action such as playing an animation or molecular rotation.

◄ Return

Exit Notes Chapter Index Previous Chapter Next Chapter Tools ActivChemistry

4 • Chemical Reactions 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

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