



This is “Art and Photo Credits”, appendix 10 from the book [Principles of General Chemistry \(index.html\)](#) (v. 1.0M).

This book is licensed under a [Creative Commons by-nc-sa 3.0](http://creativecommons.org/licenses/by-nc-sa/3.0/) license. See the license for more details, but that basically means you can share this book as long as you credit the author (but see below), don't make money from it, and do make it available to everyone else under the same terms.

This content was accessible as of December 29, 2012, and it was downloaded then by [Andy Schmitz](#) (<http://lardbucket.org>) in an effort to preserve the availability of this book.

Normally, the author and publisher would be credited here. However, the publisher has asked for the customary Creative Commons attribution to the original publisher, authors, title, and book URI to be removed. Additionally, per the publisher's request, their name has been removed in some passages. More information is available on this project's [attribution page](http://2012books.lardbucket.org/attribution.html?utm_source=header).

For more information on the source of this book, or why it is available for free, please see [the project's home page](#) (<http://2012books.lardbucket.org/>). You can browse or download additional books there.

Chapter 34

Art and Photo Credits

34.1 Molecular Models

We wish to thank the Cambridge Crystallographic Data Centre (CCDC) and the Fachinformationszentrum Karlsruhe (FIZ Karlsruhe) for allowing Imagineering Media Services (IMS) to access their databases of atomic coordinates for experimentally determined three-dimensional structures. CCDC's **Cambridge Structural Database (CSD)** is the world repository of small molecule crystal structures (distributed as part of the CSD System), and in FIZ Karlsruhe's **Inorganic Crystal Structure Database (ICSD)** is the world's largest inorganic crystal structure database. The coordinates of organic and organometallic compounds in CSD and inorganic and intermetallic compounds in ICSD were invaluable in ensuring the accuracy of the molecular models produced by IMS for this textbook. The authors, the publisher, and IMS gratefully acknowledge the assistance of both organizations. Any errors in the molecular models in this text are entirely the responsibility of the authors, the publisher, and IMS.

The CSD System: The Cambridge Structural Database: a quarter of a million crystal structures and rising. Allen, F.H., *Acta Cryst.* (2002), **B58**, 380–388. *ConQuest: New Software for searching the Cambridge Structural Database and visualizing crystal structures.* Bruno, I.J., Cole, J.C., Edgington, P.R., Kessler, M., Macrae, C.F., McCabe, P., Pearson, J., Taylor, R., *Acta Cryst.* (2002), **B58**, 389–397. *IsoStar: IsoStar: A Library of Information about Nonbonded Interactions.* Bruno, I.J., Cole, J.C., Lommerse, J.P.M., Rowland, R.S., Taylor, R., Verdonk, M., *Journal of Computer-Aided Molecular Design* (1997), **11-6**, 525–537.

The Inorganic Crystal Structure Database (ICSD) is produced and owned by Fachinformationszentrum Karlsruhe (FIZ Karlsruhe) and National Institute of Standards and Technology, an agency of the U.S. Commerce Department's Technology Administration (NIST).

34.2 Photo Credits

Chapter 1 "Introduction to Chemistry": Opening photo IBM Almaden Research Center Visualization Laboratory; **Figure 1.1 "Chemistry in Everyday Life"** Kristin Piljay, Benjamin Cummings Publishers, Pearson Education; **Figure 1.2 "Evidence for the Asteroid Impact That May Have Caused the Extinction of the Dinosaurs"(a)** Lawrence Berkeley National Laboratory; **Figure 1.2 "Evidence for the Asteroid Impact That May Have Caused the Extinction of the Dinosaurs"(b)** left and right Lawrence Berkeley National Laboratory; **Figure 1.6 "The Three States of Matter"** center Richard Megna/Fundamental Photographs; **Figure 1.6 "The Three States of Matter"** left and right Dorling Kindersley; **Figure 1.7 "A Heterogeneous Mixture"** left Michael Dalton/Fundamental Photographs; **Figure 1.7 "A Heterogeneous Mixture"** right Dorling Kindersley; **Figure 1.8 "The Distillation of a Solution of Table Salt in Water"** Richard Megna/Fundamental Photographs; **Figure 1.9 "The Crystallization of Sodium Acetate from a Concentrated Solution of Sodium Acetate in Water"** Richard Megna/Fundamental Photographs; **Figure 1.10 "The Decomposition of Water to Hydrogen and Oxygen by Electrolysis"** Charles D. Winters/Photo Researchers; **Figure 1.12 "The Difference between Extensive and Intensive Properties of Matter"** left and right Dorling Kindersley; **Figure 1.13 "An Alchemist at Work"** The Alchemist's Workshop, 1570, Jan van der Straet (Joannes Stradanus), Palazzo Vecchio, Florence, Italy; Bridgeman Art Library; **Figure 1.16 "A Gas Discharge Tube Producing Cathode Rays"** Richard Megna/Fundamental Photographs; **Section 1.5.2 "Radioactivity"** Laboratoire Curie, Institut du Radium, Paris

Chapter 2 "Molecules, Ions, and Chemical Formulas": Opening photo Courtesy of ConocoPhillips; **Figure 2.7 "Sodium Chloride: an Ionic Solid"** Jeremy Burgess/Photo Researchers, Inc.; **Figure 2.9 "Loss of Water from a Hydrate with Heating"** top and bottom Richard Megna/Fundamental Photographs; **Section 2.3 "Naming Ionic Compounds"** (The bottom of a boat) Dave G. Houser/CORBIS; **Section 2.3 "Naming Ionic Compounds"** (Pigment in dark green paints) top and bottom Dorling Kindersley; **Section 2.6.2 "Sulfuric Acid"** The Canadian National Railway Historic Photograph Collection

Chapter 3 "Chemical Reactions": Opening photo Chip Clark; **Figure 3.1 "Samples of 1 Mol of Some Common Substances"** Chip Clark; **Figure 3.3 " "(a)** Christine Chase; **Figure 3.3 " "(b)** David Scharf/Peter Arnold, Inc.; **Figure 3.7 "An Ammonium Dichromate Volcano: Change during a Chemical Reaction"** left and right Chip Clark; **Section 3.3.1 "Interpreting Chemical Equations"** Associated Press; **Figure 3.9 "An Example of a Combustion Reaction"** Richard Megna/Fundamental Photographs; **Figure 3.10 "Balancing Equations"** Carey B. Van Loon;

Section 3.3.2 "Balancing Simple Chemical Equations" (Commercial use of fermentation) Stephen J. Kron, University of Chicago; **Section 3.4.1 "Stoichiometry Problems"** NASA; **Section 3.3.2 "Balancing Simple Chemical Equations"**(Commercial use of fermentation) bottom Mason Morfit/Taxi; **Section 3.4.2 "Limiting Reactants"** Michael Freeman/CORBIS; **Section 3.4.3 "Percent Yield"** top Dorling Kindersley; **Section 3.4.3 "Percent Yield"** bottom Chip Clark; **Section 3.5.2 "Condensation Reactions"** (AgCl(s) precipitates) Chip Clark; **Section 3.5.3 "Catalysts"** Johnson Matthey PLC. Science Photo Library/Photo Researchers; **Figure 3.15 "Satellite Photos of Earth Reveal the Sizes of the Antarctic Ozone Hole over Time"** NASA

Chapter 4 "Reactions in Aqueous Solution": Opening photo Richard Megna/Fundamental Photographs; **Figure 4.4 "The Effect of Ions on the Electrical Conductivity of Water"** (a)–(c) Richard Megna/Fundamental Photographs; **Figure 4.9 "Dissolution of 1 mol of an Ionic Compound"** Dorling Kindersley; **Section 4.3.2 "Limiting Reactants in Solutions"** (A Breathalyzer ampul) Richard Megna/Fundamental Photographs; **Figure 4.11 "What Happens at the Molecular Level When Solutions of AgNO₃"** Richard Megna/Fundamental Photographs; **Section 4.5.1 "Predicting Solubilities"** (An x-ray) Richard Megna/Fundamental Photographs; **Section 4.5.2 "Precipitation Reactions in Photography"** (Silver bromide crystals) Richard Megna/Fundamental Photographs; **Figure 4.13 "Outline of the Steps Involved in Producing a Black-and-White Photograph"** PhotoDisc; **Section 4.6.1 "Definitions of Acids and Bases"** top and bottom Dorling Kindersley; **Figure 4.14 "The Reaction of Dilute Aqueous HNO₃"** Richard Megna/Fundamental Photographs; **Section 4.6.5 "Neutralization Reactions"** (Stomach acid) Digital Vision; **Figure 4.16 "Two Ways of Measuring the pH of a Solution: pH Paper and a pH Meter"** Richard Megna/Fundamental Photographs; **Figure 4.18 "Acid Rain Damage to a Statue of George Washington"** Spencer Platt/Getty Images; **Figure 4.19 "Acid Rain Damage to a Forest in the Czech Republic"** Oliver Strowe/Stone; **Figure 4.20 "Rust Formation"** Ferrell McCollough/Visuals Unlimited; **Figure 4.21 "The Single-Displacement Reaction of Metallic Copper with a Solution of Silver Nitrate"** Peticolas/Megna/Fundamental Photographs; **Section 4.8.2 "Redox Reactions of Solid Metals in Aqueous Solution"** (Corroded battery terminals) Ed Degginger/Color-Pic; **Figure 4.22 "The Activity Series"** Richard Megna/Fundamental Photographs; **Figure 4.23 "The Titration of Oxalic Acid with Permanganate"** left and right Richard Megna/Fundamental Photographs

Chapter 5 "Energy Changes in Chemical Reactions": Opening photo Richard Megna/Fundamental Photographs; **Section 5.5.1 "Fuels"** (Measuring crude oil) Reuters/CORBIS; **Figure 5.1 "Forms of Energy"**(a) NASA; **Figure 5.1 "Forms of Energy"**(b) Joanna B. Pinneo/Aurora & Quanta Productions Inc.; **Figure 5.1 "Forms of Energy"**(c) Herrmann/Starke/CORBIS; **Figure 5.1 "Forms of Energy"**(d) Los

Alamos National Laboratory; **Figure 5.1 "Forms of Energy"**(e) Robert Llewellyn/CORBIS; **Figure 5.2 "Interconversion of Forms of Energy"** David W. Hamilton/Image Bank; **Figure 5.3 "An Example of Mechanical Work"** Bettmann/CORBIS; **Figure 5.10 "Elemental Carbon"** General Electric Corporate Research & Development Center; **Figure 5.12 "An Instant Hot Pack Based on the Crystallization of Sodium Acetate"** Richard Megna/Fundamental Photographs; **Section 5.5.1 "Fuels"** (Measuring crude oil) Reuters/CORBIS; **Figure 5.20 "A Peat Bog"** Brian Lightfoot/Agefotostock

Chapter 6 "The Structure of Atoms": Opening photo Richard Megna/Fundamental Photographs; **Figure 6.1 "A Wave in Water"** Alex Howe/Image State; **Figure 6.4 "The Electromagnetic Spectrum"** Andrew Davidhazy; **Figure 6.5 "Blackbody Radiation"** left PhotoDisc Red; **Figure 6.5 "Blackbody Radiation"** right Dorling Kindersley; **Figure 6.8 "A Beam of Red Light Emitted by a Ruby Laser"** agefotostock; **Figure 6.9 "The Emission of Light by Hydrogen Atoms"**(a) Charles Winters/Photo Researchers; **Figure 6.9 "The Emission of Light by Hydrogen Atoms"**(b) top Richard Megna/Fundamental Photographs; **Figure 6.13 "The Emission Spectra of Elements Compared with Hydrogen"**(a)–(c) "Simultaneous Display of Spectral Images and Graphs Using a Web Camera and Fiber Optic Spectrometer" by Brian Niece. Journal of Chemical Education. **Section 6.3.3 "Applications of Emission and Absorption Spectra"** (Absorption of light) the International Dark-Sky Association, www.darksky.org; **Figure 6.14 "The Visible Spectrum of Sunlight"** the International Dark-Sky Association, www.darksky.org; **Section 6.3.3 "Applications of Emission and Absorption Spectra"** (Sodium and mercury spectra) the International Dark-Sky Association, www.darksky.org; **Figure 6.15 "The Chemistry of Fireworks"**(a) Jeff Hunter/The Image Bank/Getty Images; **Section 6.3.3 "Applications of Emission and Absorption Spectra"** (CD) Laboratory for Microscopy and Micro-analysis, University of Pretoria, South Africa; **Figure 6.17 "A Comparison of Images Obtained Using a Light Microscope and an Electron Microscope"** (a) and (b) Chris Hollis; **Section 6.3.3 "Applications of Emission and Absorption Spectra"** (He emission spectrum) "Simultaneous Display of Spectral Images and Graphs Using a Web Camera and Fiber Optic Spectrometer" by Brian Niece. Journal of Chemical Education.

Chapter 7 "The Periodic Table and Periodic Trends": Opening photo Science & Society Picture Library/Science Museum, London; **Section 7.4.1 "The Main Group Elements"** Richard Megna/Fundamental Photographs

Chapter 8 "Ionic versus Covalent Bonding": Opening photo Richard Megna/Fundamental Photographs; **Figure 8.6 "G. N. Lewis and the Octet Rule"** University Archives, the Bancroft Library, University of California, Berkeley; **Figure 8.10 "The**

Three Allotropes of Phosphorus: White, Red, and Black" Justin Urgitis/
www.chemicalforums.com

Chapter 9 "Molecular Geometry and Covalent Bonding Models": Opening photo Jian-Min Zuo, Miyoung Kim, Michael O'Keefe and John Spence, Arizona State University; **Figure 9.27 "Liquid O"** Richard Megna/Fundamental Photographs

Chapter 10 "Gases": Opening photo CORBIS; **Figure 10.15 "The Diffusion of Gaseous Molecules"** Richard Megna/Fundamental Photographs; **Figure 10.16 "A Simple Experiment to Measure the Relative Rates of the Diffusion of Two Gases"** Richard Megna/Fundamental Photographs; **Figure 10.18 "A Portion of a Plant for Separating Uranium Isotopes by Effusion of UF"** U.S. Department of Energy/ Photo Researchers, Inc.; **Figure 10.25 "A Liquid Natural Gas Transport Ship"** Network Photographers/Alamy

Chapter 11 "Liquids": Opening photo Oleg D. Lavrentovich, Liquid Crystal Institute, Kent State University; **Figure 11.2 "Why Liquids Flow"** Kristen Brochmann Fundamental Photographs; **Figure 11.10 "The Effects of the High Surface Tension of Liquid Water"(a)** Chip Clark; **Figure 11.10 "The Effects of the High Surface Tension of Liquid Water"(b)** Herman Eisenbeiss/ Photo Researchers, Inc.; **Figure 11.11 "The Phenomenon of Capillary Action"** Richard Megna/Fundamental Photographs; **Figure 11.12 "The Effects of Capillary Action"(b)** Richard Megna/Fundamental Photographs; **Figure 11.18 "The Sublimation of Solid Iodine"** Richard Megna/Fundamental Photographs; **Figure 11.21 "Supercritical Benzene"** Division of Chemical Education, Inc., American Chemical Society; **Figure 11.25 "Cholesteryl Benzoate"(a)-(b)** Richard Megna/Fundamental Photographs; **Figure 11.29 "An Inexpensive Fever Thermometer That Uses Liquid Crystals"** Liquid Crystal Resources

Chapter 12 "Solids": Opening photo M. C. Escher's "Symmetry Drawing E128" © 2005 The M. C. Escher Company—Holland. All rights reserved. www.mcescher.com; **Section 12.1 "Crystalline and Amorphous Solids"** all photos Dorling Kindersley; **Figure 12.13 "X-Ray Diffraction"(b)** ArsNatura; **Figure 12.16 "Edge Dislocations"** left Dorling Kindersley; **Section 12.4.2 "Memory Metal"** Photo Researchers, Inc.; **Section 12.4.3 "Defects in Ionic and Molecular Crystals"** all photos Dorling Kindersley; **Figure 12.29 "The Meissner Effect"(b)** J.H. Rector courtesy of R. Griessen, Vrije Universiteit, Amsterdam, The Netherlands; **Figure 12.33 "Sintering"** Suminar Pratapa and Brian O'Connor (Curtin University of Technology) and Brett Hunter (ANSTO), Bragg Institute, Australian Nuclear Science and Technology Organisation

Chapter 13 "Solutions": Opening photo TPL Distribution/Photolibrary; **Figure 13.2 "Commercial Cold Packs for Treating Injuries"** Dorling Kindersley; **Figure 13.5 "Immiscible Liquids"** Richard Megna/Fundamental Photographs; **Figure 13.8 "Effect of a Crown Ether on the Solubility of KMnO_4 "** Richard Megna/Fundamental Photographs; **Figure 13.19 "Effect on Red Blood Cells of the Surrounding Solution's Osmotic Pressure"(a)–(c)** Sam Singer/ArsNatura; **Figure 13.22 "Tyndall Effect, the Scattering of Light by Colloids"** Richard Megna/Fundamental Photographs; **Figure 13.23 "Sickle-Cell Anemia"** Oliver Meckes & Nicole Ottawa/Photo Researchers, Inc.; **Figure 13.24 "Formation of New Land by the Destabilization of a Colloid Suspension"** John F. Kennedy Space Center/NASA

Chapter 14 "Chemical Kinetics": Opening photo Fritz Goro; **Figure 14.1 "The Effect of Concentration on Reaction Rates"** Chip Clark; **Figure 14.2 "The Effect of Temperature on Reaction Rates"** Chip Clark; **Figure 14.3 "The Effect of Surface Area on Reaction Rates"** Chip Clark; **Figure 14.4 "The Effect of Catalysts on Reaction Rates"** Chip Clark; **Figure 14.28 "A Catalytic Defense Mechanism"** Thomas Eisner

Chapter 15 "Chemical Equilibrium": Opening photo James Whitlow Delano/Redux; **Figure 15.1 "The "** Richard Megna/Fundamental Photographs; **Section 15.3.2 "Calculating Equilibrium Concentrations from the Equilibrium Constant"** (Laboratory apparatus) Deutsches Museum, Munich; **Figure 15.12 "The Effect of Changing the Volume (and Thus the Pressure) of an Equilibrium Mixture of N_2 "** Richard Megna/Fundamental Photographs; **Figure 15.13 "The Effect of Temperature on the Equilibrium between Gaseous N_2 "** Richard Megna/Fundamental Photographs

Chapter 16 "Aqueous Acid–Base Equilibria": Opening photo Richard Megna/Fundamental Photographs; **Figure 16.22 "Naturally Occurring pH Indicators in Red Cabbage Juice"** Richard Megna/Fundamental Photographs; **Figure 16.24 "Choosing the Correct Indicator for an Acid–Base Titration"** Richard Megna/Fundamental Photographs; **Figure 16.25 "pH Paper"** Richard Megna/Fundamental Photographs

Chapter 17 "Solubility and Complexation Equilibria": Opening photo Andrew Syred/Photo Researchers; **Section 17.1.1 "The Solubility Product"** (A crystal of calcite) Chip Clark; **Figure 17.4 "The Formation of Complex Ions"** Richard Megna/Fundamental Photographs; **Figure 17.5 "An MRI Image of the Heart, Arteries, and Veins"** Wesley Vick and Taylor Chung, Baylor College of Medicine, Houston; **Figure 17.6 "The Chemistry of Cave Formation"(a)** Martin Siepmann/AGEfotostock; **Figure 17.6 "The Chemistry of Cave Formation"(b)** Chase Studio/Photo Researchers; **Figure 17.7 "Solubility Equilibria in the**

Formation of Karst Landscapes" Carl & Ann Purcell/CORBIS; **Figure 17.9 "Chromium(III) Hydroxide [Cr(OH)₃]"** Richard Megna/Fundamental Photographs; **Figure 17.11 "The Separation of Metal Ions from Group 1 Using Qualitative Analysis"** Richard Megna/Fundamental Photographs

Chapter 18 "Chemical Thermodynamics": Opening photo Robert Llewellyn/Image State; **Figure 18.1 "Altitude Is a State Function"** Robert Harding Picture Library Ltd./Photolibrary; **Figure 18.2 "The Relationship between Heat and Work"** top Bettmann/CORBIS; **Figure 18.2 "The Relationship between Heat and Work"**bottom Bettmann/CORBIS; **Figure 18.6 "An Endothermic Reaction"** Richard Megna/Fundamental Photographs; **Figure 18.7 "Illustrating Low- and High-Entropy States with a Deck of Playing Cards"** Richard Megna/Fundamental Photographs; **Figure 18.11 "Thermograms Showing That Heat Is Absorbed from the Surroundings When Ice Melts at 0°C"** James Klett, Oak Ridge National Laboratory; **Figure 18.12 "Spontaneous Transfer of Heat from a Hot Substance to a Cold Substance"** Olivier Grunewald/Photolibrary; **Figure 18.15 "Two Forms of Elemental Sulfur and a Thermodynamic Cycle Showing the Transition from One to the Other"** left Dorling Kindersley; **Figure 18.15 "Two Forms of Elemental Sulfur and a Thermodynamic Cycle Showing the Transition from One to the Other"** right Andrew Lambert Photography/Photo Researchers

Chapter 19 "Electrochemistry": Opening photo Paul Chesley/National Geographic/Getty Images; **Figure 19.2 "The Reaction of Metallic Zinc with Aqueous Copper(II) Ions in a Single Compartment"** Richard Megna/Fundamental Photographs; **Figure 19.3 "The Reaction of Metallic Zinc with Aqueous Copper(II) Ions in a Galvanic Cell"**(b) Stephen Frisch/Stock Boston; **Section 19.1.1 "Galvanic (Voltaic) Cells"** (A galvanic cell) Richard Megna/Fundamental Photographs; **Figure 19.8 "The Reaction of Dichromate with Iodide"** Richard Megna/Fundamental Photographs; **Section 19.5.1 "Batteries".3 (Cardiac pacemaker)** Charles O'Rear/CORBIS; **Figure 19.23 "The Electrolysis of Water"** Charles D. Winters/Photo Researchers; **Figure 19.24 "Electroplating"** Sam Ogden/Photo Researchers

Chapter 20 "Nuclear Chemistry": Opening photo US Dept. of Energy/SPL/Photo Researchers; **Figure 20.9 "A Linear Particle Accelerator"**(a) Michael Collier; **Figure 20.10 "A Synchrotron"** Fermilab Visual Media Services; **Figure 20.11 "Radiation Damage"** Dwayne Anthony and the National Insulator Association; **Section 20.5 "Applied Nuclear Chemistry"** (Pitchblende) Thomas Seilnacht; **Figure 20.19 "A "Fossil Nuclear Reactor" in a Uranium Mine Near Oklo in Gabon, West Africa"** Robert D. Loss, WALSRC; **Figure 20.20 "The Chernobyl Nuclear Power Plant"** NOVOSTI/SIPA; **Figure 20.22 "Two Possible Designs for a Nuclear Fusion Reactor"**(a) Plasma Physics Laboratory, Princeton University; **Figure 20.22 "Two Possible Designs for a Nuclear Fusion Reactor"**(b) Lawrence

Livermore National Laboratory; **Figure 20.23 "Medical Imaging and Treatment with Radioisotopes"(a)** Chris Priest/SPL/Photo Researchers; **Figure 20.23 "Medical Imaging and Treatment with Radioisotopes"(b)** Simon Fraser/SPL/Photo Researchers; **Figure 20.24 "The Preservation of Strawberries with Ionizing Radiation"** International Atomic Energy Agency; **Figure 20.28 "A Supernova"** Space Telescope Science Institute

Chapter 21 "Periodic Trends and the ": Opening photo Journal of Chemical Education; **Figure 21.6 "The Explosive Properties of Hydrogen"** Bettmann/CORBIS; **Section 21.3.3 "Reactions and Compounds of the Alkali Metals"** (A crystal of spodumene) Dorling Kindersley; **Figure 21.8 "The Trisulfide Anion Is Responsible for the Deep Blue Color of Some Gemstones"** Dorling Kindersley; **Figure 21.10 "Reacting Sodium with Water"** Richard Megna/Fundamental Photographs; **Figure 21.11 "Alkali Metal-Liquid Ammonia Solutions"** Richard Megna/Fundamental Photographs; **Section 21.4.1 "Preparation of the Alkaline Earth Metals"** (A crystal of beryl and a crystal of strontianite) Dorling Kindersley; **Figure 21.13 "Magnesium Alloys Are Lightweight and Corrosion Resistant"** Hulton Archive/Getty Images

Chapter 22 "The ": Opening photo Roger Hayward; **Figure 22.1 "Borax Deposits"(a)** Dorling Kindersley; **Figure 22.1 "Borax Deposits"(b)** The Dial Corporation; **Section 22.1.2 "Reactions and Compounds of Boron"** (Cubic BN crystals and natural industrial diamonds) Indus Global Superabrasives; **Figure 22.5 "Very Small Particles of Noncrystalline Carbon Are Used to Make Black Ink"(a)** Dorling Kindersley; **Figure 22.5 "Very Small Particles of Noncrystalline Carbon Are Used to Make Black Ink"(b)** Brooklyn Museum of Art/CORBIS; **Figure 22.6 "Crystalline Samples of Carbon and Silicon, the Lightest Group 14 Elements"(a)** AP/Wide World Photos; **Figure 22.6 "Crystalline Samples of Carbon and Silicon, the Lightest Group 14 Elements"(b)** Texas Instruments Incorporated; **Section 22.2.2 "Reactions and Compounds of Carbon"** (Miner's lamp) Inner Mountain Outfitters; **Section 22.2.3 "Reactions and Compounds of the Heavier Group 14 Elements"** (Child with Silly Putty) Roger Ressmeyer/CORBIS; **Figure 22.10 "The Ancient Egyptians Used Finely Ground Antimony Sulfide for Eye Makeup"(a)** Dorling Kindersley; **Figure 22.10 "The Ancient Egyptians Used Finely Ground Antimony Sulfide for Eye Makeup"(b)** Erich Lessing/Art Resource. NY; **Section 22.4 "The Elements of Group 16 (The Chalcogens)"** (Sulfur deposit) David Cavagnaro/Visuals Unlimited; **Section 22.4.1 "Preparation and General Properties of the Group 16 Elements"** (Iron pyrite) Photolibrary; **Section 22.5 "The Elements of Group 17 (The Halogens)"** (A crystal of fluorite) Paul Silverman/Fundamental Photographs; **Figure 22.14 "Isolation of Elemental Fluorine"** Science & Society Picture Library/Science Museum, London; **Figure 22.15 "A Subterranean Salt Mine"** Ferdinando Scianna/Magnum Photos; **Section 22.6.2 "Reactions and Compounds of the Noble Gases"** ("Burning snowballs")

Kazuhiro Nogi/AFP/Getty Image; **Figure 22.1 "Borax Deposits"**.⁷ Walter Gruber, University of British Columbia. Collection of Neil Bartlett

Chapter 23 "The "": Opening photo Txomin Sáez/AGEfotostock; **Figure 23.4 "Aqueous Solutions of Vanadium Ions in Oxidation States of +2 to +5"** Richard Megna/Fundamental Photographs; **Figure 23.5 "Compounds of Manganese in Oxidation States +2 to +7"** Richard Megna/Fundamental Photographs; **Section 23.2.3 "Groups 8, 9, and 10" (Coins)** Doug Smith; **Section 23.2.4 "Groups 11 and 12" (Gold nugget)** Ted Aljibe/AEP/Getty Images; **Section 23.2.4 "Groups 11 and 12" (Chuquicamata copper mine)** Martin Bernetti/AFP/Getty Images; **Figure 23.6 "Froth Flotation"** Johnson Matthey; **Figure 23.7 "A Blast Furnace for Converting Iron Oxides to Iron Metal"** Margaret Bouke-White/Time Life Pictures/Getty Images; **Figure 23.8 "A Basic Oxygen Furnace for Converting Crude Iron to Steel"** Alex Webb/Magnum Photos; **Section 23.5.5 "Crystal Field Stabilization Energies" (Crystals of ruby and emerald)** Dorling Kindersley

Chapter 24 "Organic Compounds": Opening photo After Eddaoudi, M.; Kim, J.; O'Keeffe, M.; Yaghi, O. M. J. Am. Chem. Soc. 2002, 124, 376, Figure 1. Crystallographic data (ja017154e_s2.cif) available at <http://pubs.acs.org>; **Figure 24.24 "Plaque in an Artery"** Eye of Science/Photo Researchers; **Section 24.2.3 "Stereoisomers" (Milk and tobacco)** Dorling Kindersley; **Section 24.2.3 "Stereoisomers".2left (Caraway seeds)** Dorling Kindersley; **Section 24.2.3 "Stereoisomers".2 right (Spearmint oil)** James Baigrie/Foodpix/Jupiter Images; **Section 24.5.6 "Carboxylic Acid Derivatives" (Fruit fly and banana)** Dorling Kindersley