

Photo Credits

2-3 (background), © R. Kord/Firstlight.ca; 2-3 (background), Artbase Inc.; 2-3 (background), Ludek Pesek/Science Photo Library/Photo Researchers Inc.; 4 (background), NASA/NSSCD; 4 (bottom right), Artbase Inc.; 5 (bottom left), Artbase Inc.; 6 (bottom right), © Ron Sherman/Stone; 6 (centre right), © Ron Fehling/Masterfile; 7 (centre left), Artbase Inc.; 7 (centre right), © Tom Stewart/The Stock Market/Firstlight.ca; 9 (centre left), © Sun Media Corporation; 16 (bottom centre), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; 23 (top left), Artbase Inc.; 32 (background), Darius Kochli/Firstlight.ca; 32 (bottom left), Armstrong Roberts/Comstock; 32 (background), Artbase Inc.; 40 (bottom), © Stephen Frish Photography; 42 (top), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; 56 (top left), © Patrick Bennett/Corbis/Magma; 58 (top left), © Magma Photo News; 64 (background), © Underwood & Underwood/Corbis/Magma; 64 (top right), Anthony Howard/Masterfile; 65 (bottom left), © Catherine Ursillo/Photo Researchers Inc.; 66 (centre left), © George Bernard/Science Photo Library/Photo Researchers, Inc.; 66 (centre right), © Geoff Tompkinson/Science Photo Library/Photo Researchers, Inc.; 69 (top right), © Larry Stepanowicz/Visuals Unlimited, Inc.; 69 (centre left), © Gary Griffen/Animals Animals/Earth Scenes; 69 (bottom right), Artbase Inc.; 70 (top left), © Dick Hemingway; 72 (top right), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; 83 (bottom right), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; 85 (centre left), © Jean Marc Barey/Agence Vandystadt/Photo Researchers, Inc.; 85 (centre left), Artbase Inc.; 90 (centre right), © Stephen Dalton/Photo Researchers, Inc.; 93 (background), Artbase Inc.; 110 (background), © Mike Timo/STONE; 110 (bottom left), © Mike & Carol Werner/Stock, Boston Inc./PictureQuest; 111 (bottom left), Trevor Bonderud/Firstlight.ca; 114 (top left), Artbase Inc.; 119 (bottom left), Artbase Inc.; 119 (bottom right), © Dale Sarver/Animals Animals; 120 (centre right), Bill Ivy/Ivy Images; 121 (centre left), © Bruce Forster/STONE; 123 (top right), © Charles D. Winters/Photo Researchers; 127 (top right), from *Sciencepower 10* © 2000, McGraw-Hill Ryerson Limited; 127 (centre left), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; 141 (centre right), © Dave G. Houser/Corbis/Magma; 142 (centre left), © David Joel/STONE; 143 (centre left), VU/National Archives/Visuals Unlimited; 145 (top left), Notman Photographic Archives, McCord Museum of Canadian History, Montreal; 147 (top right), © AFP/CORBIS/MAGMA; 148-149 (background), © Notts/Firstlight.ca; 152 (centre left), COMSTOCK IMAGES/B. Pizaro; 152 (bottom left), © Russell D. Curtis/Photo Researchers, Inc.; 172 (centre right), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; 173 (bottom left), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; 174 (centre left), © Walter Schmid/Stone Images; 177 (bottom right), Artbase Inc.; 192 (top left), © Nino Mascardi/Image Bank; 196 (background), Inga Spence/Index Stock Imagery; 196 (bottom right), Jackson Vereen/Food Pix; 198 (bottom right), Index Stock Imagery; 198 (bottom left), © Larry Williams/Masterfile; 198 (bottom right), Didier Givois/Allsport USA; 205 (centre), from *Sciencepower 8* © 2000, McGraw-Hill Ryerson Limited; 211 (centre right), © Will & Deni McIntyre/Photo Researchers, Inc.; 216 (top left), Chris Mikula/The Ottawa Citizen; 222 (centre left), © Mark Stephenson/Firstlight.ca; 223 (centre right), Angle Wynn/Native Stock; 232 (bottom left), NASA/Science Photo Library/Photo Researchers; 233 (bottom left), NASA; 236 (top right), © Thomas Dressler/First Light Associated Photographers; 242 (centre right), NASA; 244 (centre left), Neil Bartlett/B. C. Jennings Photographer; 248 (centre left), © Crown/Health & Safety Laboratory/Science Photo Library/Photo Researchers, Inc.; 252 (top left), © Nancy Richmond/Ivy Images; 260 (centre right), Artbase Inc.; 265 (top left), V.C.L./Spencer Rowell/FPG International; 268 (top left), © Ed Gifford/Masterfile; 274 (centre left), © 1991, Richard T. Nowitz/Photo Researchers, Inc.; 280-281 (background), © Carolyn A. McKeone/Photo Researchers, Inc.; 282 (background), © C. Dass/Firstlight.ca; 282 (bottom centre), © Chris Vincent/Firstlight.ca; 283 (bottom left), © Christian Michaels/FPG International; 285 (top left), © Larry Stepanowicz/Visuals Unlimited, Inc.; 285 (top left), © Larry Stepanowicz/Visuals Unlimited, Inc.; 285 (top centre), © Chris Vincent/Firstlight.ca; 285 (top centre), © David Burch/Index Stock; 285 (top right), Dick Hemingway Photographs; 285 (background), © NMR/Firstlight.ca; 285 (top right), © IPS/Index Stock; 286 (bottom left), © Sovfoto/Eastfoto/PictureQuest; 290 (bottom left), © Lawrence Migdale/Science Source/Photo Researchers, Inc.; 298 (top left), © Terry C. Hazen/Visuals Unlimited, Inc.; 299 (top right), Dick Hemingway Photographs; 300 (bottom left), © Minden/Firstlight.ca; 307 (top left), Artbase Inc.; 307 (top right), Artbase Inc.; 309 (top right), © Charles D. Winters/Photo Researchers, Inc.; 310 (centre left), Dick Hemingway Photographs; 313 (centre right), © Matthias Kulka/Firstlight.ca; 319 (centre right), © Larry Stepanowicz/VISUALS UNLIMITED, INC.; 324 (top left), Artbase Inc.; 328 (background), Artbase Inc.; 328 (bottom left), Artbase Inc.; 350 (centre right), © Hans Reinhard/Okapia/Photo Researchers, Inc.; 358 (bottom right), © Geoff Tompkinson/Science Photo Library/Photo Researchers, Inc.; 360 (bottom right), © Andrew Syred/Science Photo Library/Photo Researchers, Inc.; 368 (bottom right), © McGraw Hill Higher Education/Stephen Frisch, Photographer; 368 (bottom right), © McGraw Hill Higher Education/Stephen Frisch, Photographer; 369 (bottom left), Kathleen Campbell/Stone; 373 (bottom right), © E.F. Smith Collection University of Pennsylvania Library; 375 (bottom left), © Science Photo Library/Photo Researchers, Inc.; 375 (bottom centre), © E.F. Smith Collection University of Pennsylvania Library; 385 (top left), © VU/Jeff Greenberg/MR/Visuals Unlimited; 408 (centre left), © Garry Black/Masterfile; 408 (top right), © Brian Sytnyk/Masterfile; 408 (centre right), © Gilbert&Brant/Photo Researchers, Inc.; 408 (top right), Artbase Inc.; 416 (background), © Pat Morrow/Firstlight.ca; 416 (bottom right), Comstock Photofile Limited; 417 (bottom left), © Firstlight.ca; 425 (centre left), © John Lemker/Earth Scenes; 427 (bottom left), © Damien Lovegrove/Science Photo Library/Photo Researchers, Inc.; 428 (centre right), Westerkov/Earth Scenes; 436 (bottom centre), © Bruce Davidson/Earth Scenes; 436 (bottom left), © Bruce Davidson/Earth Scenes; 436 (bottom right), © Bruce Davidson/Earth Scenes; 437 (top right), © Roy Ooms/Masterfile; 450 (bottom left), Artbase Inc.; 451 (top right), Michelle Del Guercio/Photo Researchers Inc.; 452 (centre left), Paul Rocheleau/Index Stock; 458 (centre left), Science Photo Library/Photo Researchers; 458 (bottom left), D&J Heaton/Stock Boston; 462 (bottom

left), © James King-Holmes/Science Photo Library/Photo Researchers, Inc.; **462** (bottom right), Artbase Inc.; **463** (centre left), © Michael Creagen Photography; **464** (bottom left), © Bob Peterson/FPG International; **464** (bottom right), Artbase Inc.; **465** (bottom right), © Kevin Aitken/Firstlight; **468** (background), © Benelux Press/Masterfile; **468** (bottom left), North Wind Picture Archives; **469** (bottom left), COMSTOCK IMAGES; **470** (centre left), © Science Photo Library/Photo Researchers, Inc.; **470** (centre), © Science Photo Library/Photo Researchers, Inc.; **470** (centre right), © Science Photo Library/Photo Researchers, Inc.; **487** (centre left), © Bart Vallecoccia/Masterfile; **488** (bottom left), © Jeff Perrell/Masterfile; **489** (centre left), © David & Peter Turnley/CORBIS/MAGMA; **490** (top right), © Ralph Reinhold/Earth Scenes; **492** (top right), © E.R. Degginger/Earth Scenes; **496** (top left), © Charles D. Winters/Science Photo Library/Photo Researchers, Inc.; **504** (top left), Samuel Ashfield/FPG International; **505** (top right), © Charles D. Winters/Science Photo Library/Photo Researchers, Inc.; **507** (bottom right), Visuals Unlimited, Inc.; **513** (centre left), © Ned Therrien/Visuals Unlimited, Inc.; **514** (bottom left), © Peter Christopher/Masterfile; **515** (centre right), Artbase Inc.; **516** (top left), © Charles D. Winters/Science Photo Library/Photo Researchers, Inc.; **517** (top right), © NOAA/Science Photo Library/Photo Researchers, Inc.; **518** (top left), P.A. Ariya; **526** (bottom left), Comstock Images; **526** (top right), VU/© Bernd Wittich/Visuals Unlimited, Inc.; **532** Richard Dunoff/First Light Associates; **532** (background), © Richard Dunoff/Firstlight.ca; **533** (bottom left), Artbase Inc.; **536** (bottom left), © University of Alberta Imaging Centre 1999; **538** (top right), © 2000, Rosemary Weller/Stone; **561** (centre left), © David Hall/Masterfile; **568** (centre right), © Mike Dobel, MCMX-CI/Masterfile; **572** (top left), © Michael Branscom Photography; **572** (centre right), © K9 Storm Inc.; **576** (background), Artbase Inc.; **576** (bottom right), Artbase Inc.; **578** (bottom right), © Peter Christopher/Masterfile; **578** (centre right), © Firstlight.ca; **578** (centre left), © Marilyn "Angel" Wynn/Native Stock; **580** (top left), © Lowell Georgia/Photo Researchers, Inc.; **580** (bottom right), © Phil Degginger/Color-Pic, Inc.; **580** (bottom left), © Alan Marsh/First Light; **588** (bottom left), © Charles D. Winters/Photo Researchers, Inc.; **595** (top right), Artbase Inc.; **601** (top left), Artbase Inc.; **603** (centre right), Holton Getty/Designed by Laplace and Lavoisier; **606** (top left), Comstock Photofile Limited; **609** (centre left), © Stephen Frish/Stock, Boston/PictureQuest; **612** (centre), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; **613** (top left), © Eastcott/Momatiuk/Animals Animals; **613** (bottom left), © Stephen Frish/Stock, Boston/PictureQuest; **615** (bottom right), Artbase Inc.; **619** (centre right), Image Courtesy GORE-TEX; **619** (centre left), © 1988, Michael Ventura/Bruce Coleman, Inc.; **619** (bottom left), Artbase Inc.; **619** (bottom right), Artbase Inc.; **620** (top left), Artbase Inc.; **622** (bottom left), © Richard Berenholtz/Firstlight.ca; **622** (centre left), © S.L.I.D.E./Phototake; **622** (centre right), © Tim Davis/Photo Researchers, Inc.; **624** (top left), © Vanessa Vick/Photo Researchers, Inc.; **629** (top right), © George Hunter/Comstock; **630** (centre left), © SIU/Visuals Unlimited; **639** (centre right), COMSTOCK IMAGES/Grant Heilman Photography; **640** (centre left), © Ken Lax/Photo Researchers, Inc.; **641** (centre right), Holt Studios International (Nigel Cattlin)/Photo Researchers Inc.; **641** (centre right), Bernd Wittich/Visuals Unlimited; **642** (centre left), © Jonathan Blair/CORBIS/MAGMA; **643** (bottom right), COMSTOCK IMAGES

Illustration Credits

16 (centre), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; **29** (centre right), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **35** (bottom right), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **54** (top left), **42** (top), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **54** (centre right), **42** (top), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **57** (bottom left), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **141** (bottom), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **166** (bottom), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **215** (centre), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **219** (bottom), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **294** (centre right), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; **301** (centre right), from *Chemistry: Concepts and Applications* © 2000, The McGraw-Hill Companies Inc.; **344** (bottom centre), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **359** (centre), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **418** (centre left), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **419** (top right), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **419** (centre right), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **432** (centre right), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **442** (top), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **476** (bottom centre), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.; **480** (bottom left), from *Chemistry: The Molecular Nature of Matter and Change*, Second Edition, by Martin S. Silberberg © 2000, The McGraw-Hill Companies Inc.

Text Credits

634–635 A portion of this material adapted from *Essential Chemistry* by Raymond Chang © 1996, McGraw-Hill