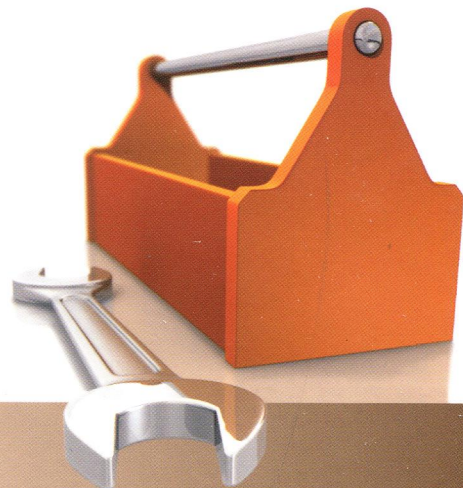
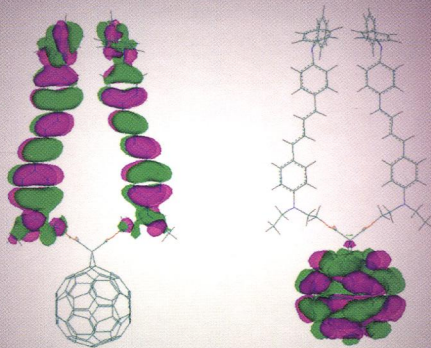


The Physical Chemist's TOOLBOX



ROBERT M. METZGER



THE PHYSICAL CHEMIST'S TOOLBOX

Robert M. Metzger



A JOHN WILEY & SONS, INC., PUBLICATION

Copyright © 2012 by John Wiley & Sons, Inc. All rights reserved

Published by John Wiley & Sons, Inc., Hoboken, New Jersey
Published simultaneously in Canada

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 750-4470, or on the web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permission>.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor author shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic formats. For more information about Wiley products, visit our web site at www.wiley.com.

Library of Congress Cataloging-in-Publication Data

Metzger, R. M. (Robert M.), 1940-
The physical chemist's toolbox / by Robert M. Metzger.
pages cm
Includes index.
ISBN 978-0-470-88925-1 (hardback)
1. Chemistry, Physical and theoretical. I. Title.
QD453.3.M48 2012
541-dc23

2011045248

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

Contents

<i>Foreword</i>	<i>vii</i>
Chapter 1 <i>Introduction: A Physical Chemists's Toolbox</i>	1
Chapter 2 <i>Particles, Forces, and Mathematical Methods</i>	5
Chapter 3 <i>Quantum Mechanics</i>	121
Chapter 4 <i>Thermodynamics</i>	244
Chapter 5 <i>Statistical Mechanics</i>	284
Chapter 6 <i>Kinetics, Equilibria, and Electrochemistry</i>	335
Chapter 7 <i>Symmetry</i>	387
Chapter 8 <i>Solid-State Physics</i>	443
Chapter 9 <i>Electrical Circuits, Amplifiers, and Computers</i>	503
Chapter 10 <i>Sources, Sensors, and Detection Methods</i>	571
Chapter 11 <i>Instruments</i>	647
Chapter 12 <i>From Crystals to Molecules</i>	781
<i>Appendix</i>	<i>823</i>
<i>Index</i>	<i>903</i>