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# AP Chemistry

2010–2011

John T. Moore  
Richard H. Langley

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New York Chicago San Francisco Lisbon London Madrid  
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# ABOUT THE AUTHORS

JOHN MOORE grew up in the foothills of western North Carolina. He attended the University of North Carolina–Asheville, where he received his bachelor's degree in chemistry. He earned his master's degree in chemistry from Furman University in Greenville, South Carolina. After a stint in the United States Army he decided to try his hand at teaching. In 1971 he joined the faculty of Stephen F. Austin State University in Nacogdoches, Texas, where he still teaches chemistry. In 1985 he started back to school part-time, and in 1991 received his doctorate in education from Texas A&M University. For the last eight years he has been co-editor, along with one of his former students, of the *Chemistry for Kids* feature of *The Journal of Chemical Education*. In 2003 his first book, *Chemistry for Dummies*, was published. For the past several years, he has been a grader for the free-response portion of the AP Chemistry exam.

RICHARD LANGLEY grew up in southwestern Ohio. He attended Miami University in Oxford, Ohio, where he earned bachelor's degrees in chemistry and mineralogy and a master's degree in chemistry. He next went to the University of Nebraska in Lincoln, where he received his doctorate in chemistry. He took a postdoctoral position at Arizona State University in Tempe, Arizona, then became a visiting assistant professor at the University of Wisconsin–River Falls. He has taught at Stephen F. Austin State University in Nacogdoches, Texas, since 1982. For the past several years, he also has been a grader for the free-response portion of the AP Chemistry exam.

The authors are also coauthors of *Chemistry for the Utterly Confused* and *Biochemistry for Dummies*.

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# CONTENTS

Preface, xiii  
Acknowledgments, xv  
Introduction: The Five-Step Program, xvii

## **STEP 1 Set Up Your Study Program, 1**

- 1 What You Need to Know About the AP Chemistry Exam, 3**  
Background of the Advanced Placement Program, 3  
Who Writes the AP Chemistry Exam?, 4  
The AP Grades and Who Receives Them, 4  
Reasons for Taking the AP Chemistry Exam, 4  
Questions Frequently Asked About the AP Chemistry Exam, 5
- 2 How to Plan Your Time, 9**  
Three Approaches to Preparing for the AP Chemistry Exam, 9  
Calendar for Each Plan, 11

## **STEP 2 Determine Your Test Readiness, 15**

- 3 Take a Diagnostic Exam, 17**  
Getting Started: The Diagnostic Exam, 18  
Answers and Explanations, 27  
Scoring and Interpretation, 30

## **STEP 3 Develop Strategies for Success, 31**

- 4 How to Approach Each Question Type, 33**  
Multiple-Choice Questions, 33  
Free-Response Questions, 36

## **STEP 4 Review the Knowledge You Need to Score High, 41**

- 5 Basics, 43**  
Units and Measurements, 44  
Dimensional Analysis—The Factor Label Method, 45  
The States of Matter, 46  
The Structure of the Atom, 46  
Periodic Table, 50  
Oxidation Numbers, 53  
Nomenclature Overview, 53  
Experimental, 59  
Common Mistakes to Avoid, 59  
Review Questions, 60  
Answers and Explanations, 63  
Free-response Questions, 64  
Answers and Explanations, 64  
Rapid Review, 65



- 6 Reactions and Periodicity, 67**  
AP Exam Format, 67  
General Aspects of Chemical Reactions and Equations, 68  
General Properties of Aqueous Solutions, 69  
Precipitation Reactions, 70  
Oxidation–Reduction Reactions, 71  
Coordination Compounds, 75  
Acid–Base Reactions, 76  
Experimental, 80  
Common Mistakes to Avoid, 80  
Review Questions, 81  
Answers and Explanations, 83  
Free-response Questions, 84  
Answers and Explanations, 85  
Rapid Review, 86
- 7 Stoichiometry, 88**  
Moles and Molar Mass, 89  
Percent Composition and Empirical Formulas, 89  
Reaction Stoichiometry, 91  
Limiting Reactants, 92  
Percent Yield, 93  
Molarity and Solution Calculations, 94  
Experimental, 95  
Common Mistakes to Avoid, 95  
Review Questions, 95  
Answers and Explanations, 98  
Free-Response Questions, 99  
Answers and Explanations, 100  
Rapid Review, 101
- 8 Gases, 102**  
Kinetic Molecular Theory, 103  
Gas Law Relationships, 104  
Experimental, 112  
Common Mistakes to Avoid, 113  
Review Questions, 114  
Answers and Explanations, 117  
Free-Response Questions, 119  
Answers and Explanations, 119  
Rapid Review, 121
- 9 Thermodynamics, 123**  
Calorimetry, 124  
Laws of Thermodynamics, 126  
Products Minus Reactants, 126  
Thermodynamics and Equilibrium, 130  
Experimental, 131  
Common Mistakes to Avoid, 131  
Review Questions, 132  
Answers and Explanations, 134

- Free-Response Questions, 134
- Answers and Explanations, 135
- Rapid Review, 135
- 10 Spectroscopy, Light, and Electrons, 137**
  - The Nature of Light, 137
  - Wave Properties of Matter, 139
  - Atomic Spectra, 139
  - Atomic Orbitals, 140
  - Experimental, 141
  - Common Mistakes to Avoid, 141
  - Review Questions, 142
  - Answers and Explanations, 143
  - Free-Response Questions, 144
  - Answers and Explanations, 144
  - Rapid Review, 145
- 11 Bonding, 147**
  - Lewis Electron-Dot Structures, 148
  - Ionic and Covalent Bonding, 148
  - Molecular Geometry—VSEPR, 152
  - Valence Bond Theory, 154
  - Molecular Orbital Theory, 155
  - Resonance, 156
  - Bond Length, Strength, and Magnetic Properties, 158
  - Experimental, 158
  - Common Mistakes to Avoid, 158
  - Review Questions, 159
  - Answers and Explanations, 161
  - Free-Response Questions, 162
  - Answers and Explanations, 162
  - Rapid Review, 164
- 12 Solids, Liquids, and Intermolecular Forces, 166**
  - Structures and Intermolecular Forces, 167
  - The Liquid State, 168
  - The Solid State, 169
  - Phase Diagrams, 170
  - Relationship of Intermolecular Forces to Phase Changes, 171
  - Experimental, 173
  - Common Mistakes to Avoid, 173
  - Review Questions, 173
  - Answers and Explanations, 176
  - Free-Response Questions, 176
  - Answers and Explanations, 177
  - Rapid Review, 177
- 13 Solutions and Colligative Properties, 179**
  - Concentration Units, 180
  - Electrolytes and Nonelectrolytes, 183
  - Colligative Properties, 183

- Colloids, 187
- Experimental, 187
- Common Mistakes to Avoid, 188
- Review Questions, 189
- Answers and Explanations, 191
- Free-Response Questions, 194
- Answers and Explanations, 194
- Rapid Review, 195
- 14 Kinetics, 197**
  - Rates of Reaction, 198
  - Integrated Rate Laws, 201
  - Activation Energy, 202
  - Reaction Mechanisms, 203
  - Catalysts, 204
  - Experimental, 204
  - Common Mistakes to Avoid, 205
  - Review Questions, 205
  - Answers and Explanations, 207
  - Free-Response Questions, 208
  - Answers and Explanations, 209
  - Rapid Review, 210
- 15 Equilibrium, 211**
  - Equilibrium Expressions, 213
  - Le Châtelier's Principle, 214
  - Acid–Base Equilibrium, 215
  - Buffers, 223
  - Titration Equilibria, 224
  - Solubility Equilibria, 228
  - Other Equilibria, 230
  - Experimental, 230
  - Common Mistakes to Avoid, 231
  - Review Questions, 231
  - Answers and Explanations, 235
  - Free-Response Questions, 237
  - Answers and Explanations, 237
  - Rapid Review, 238
- 16 Electrochemistry, 241**
  - Redox Reactions, 242
  - Electrochemical Cells, 242
  - Quantitative Aspects of Electrochemistry, 247
  - Nernst Equation, 249
  - Experimental, 250
  - Common Mistakes to Avoid, 250
  - Review Questions, 251
  - Answers and Explanations, 253
  - Free-Response Questions, 255
  - Answers And Explanations, 256
  - Rapid Review, 258

- 17 Nuclear Chemistry, 260**  
Nuclear Reactions, 260  
Nuclear Stability, 262  
Nuclear Decay Calculations, 263  
Mass–Energy Relationships, 264  
Common Mistakes to Avoid, 265  
Review Questions, 265  
Answers and Explanations, 266  
Rapid Review, 267
- 18 Organic Chemistry, 268**  
Alkanes, 268  
Structural Isomerism, 270  
Common Functional Groups, 272  
Macromolecules, 272  
Experimental, 274  
Common Mistakes to Avoid, 274  
Review Questions, 275  
Answers and Explanations, 275  
Free-Response Questions, 276  
Answers and Explanations, 276  
Rapid Review, 277
- 19 Experimental, 278**  
Experiment 1: Finding the Formula of a Compound, 279  
Experiment 2: The Percentage of Water in a Hydrate, 282  
Experiment 3: Molar Mass by Vapor Density, 283  
Experiment 4: Molar Mass by Freezing-Point Depression, 283  
Experiment 5: Molar Volume of a Gas, 285  
Experiment 6: Standardization of a Solution, 286  
Experiment 7: Acid–Base Titration, 286  
Experiment 8: Oxidation–Reduction Titration, 287  
Experiment 9: Mass/Mole Relationships in a Chemical Reaction, 288  
Experiment 10: Finding the Equilibrium Constant, 289  
Experiment 11: pH Measurements and Indicators for Acid–Base Titrations, 290  
Experiment 12: The Rate and Order of a Reaction, 290  
Experiment 13: Enthalpy Changes, 291  
Experiment 14: Qualitative Analysis of Cations and Anions, 292  
Experiment 15: Synthesis and Analysis of a Coordination Compound, 292  
Experiment 16: Gravimetric Analysis, 293  
Experiment 17: Colorimetric Analysis, 294  
Experiment 18: Chromatographic Separation, 294  
Experiment 19: Properties of Buffer Solutions, 295  
Experiment 20: An Electrochemical Series, 296  
Experiment 21: Electrochemical Cells and Electroplating, 296  
Experiment 22: Synthesis and Properties of an Organic Compound, 297  
Common Mistakes to Avoid, 297  
Review Questions, 297  
Answers and Explanations, 297  
Free-Response Questions, 297  
Answers and Explanations, 298  
Rapid Review, 300

## **STEP 5 Build Your Test-Taking Confidence, 301**

AP Chemistry Practice Exam 1, 303

AP Chemistry Practice Exam 2, 325

**Appendixes, 345**

SI Units, 347

Balancing Redox Equations Using the Ion-Electron Method, 349

Common Ions, 353

Bibliography, 356

Web sites, 357

Glossary, 358

Exam Resources, 367

Notes, 372

# PREFACE

Welcome to the AP Chemistry Five-Step Program. The fact that you are reading this preface suggests that you will be taking the AP exam in chemistry. The AP Chemistry exam is constantly evolving and so this guide has evolved. In this edition, we have updated the book to match the new AP Chemistry exam, especially the changes in the free-response section. In the new exam, questions about laboratory experiments will be treated differently than in previous years. We have revised our presentation to reflect this change. We have also significantly revised the reaction chapter to mirror the extensive changes made in the reaction question on the AP exam.

The AP Chemistry exam certainly isn't easy, but the rewards are worth it—college credit and the satisfaction of a job well done. You will have to work and study hard to do well, but we will, through this book, help you to master the material and get ready for the exam.

Both of us have many years of experience in teaching introductory general chemistry at the university level. John Moore is the author of *Chemistry for Dummies* and he and Richard “Doc” Langley have also written *Chemistry for the Utterly Confused*, a guide for college/high school students. Each of us has certain skills and experiences that will be of special help in presenting the material in this book. Richard has also taught high school science and John has years of experience teaching chemistry to both public school teachers and students. Both of us have been graders for the AP Exam chemistry free-response questions for years and have first-hand knowledge of how the exam is graded and scored. We have tried not only to make the material understandable, but also to present the problems in the format of the AP Chemistry exam. By faithfully working the problems you will increase your familiarity with the exam format, so that when the time comes to take the exam there will be no surprises.

Use this book in addition to your regular chemistry text. We have outlined three different study programs to prepare you for the exam. If you choose the year-long program, use it as you are taking your AP Chemistry course. It will provide additional problems in the AP format. If you choose one of the other two programs, use it with your chemistry textbook also; but you may need to lean a little more on this review book. Either way, if you put in the time and effort, you will do well.

Now it's time to start. Read the Introduction: The Five-Step Program; Chapter 1, What You Need to Know About the AP Chemistry Exam; and Chapter 2, How to Plan Your Time. Then, take the Diagnostic Exam in Chapter 3. Your score will show how well you understand the material right now and point out weak areas that may need a little extra attention. Use the review exams at the end of the chapters to check your comprehension. Also pay attention to the free-response questions. That is where you can really shine, and they are worth almost as much as the multiple-choice part. Use the Rapid Reviews to brush up on the important points in the chapters. Keep this book handy—it is going to be your friend for the next few weeks or months.

Good luck: but remember that luck favors the prepared mind.

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# INTRODUCTION: THE FIVE-STEP PROGRAM

## The Basics

Not too long ago, you enrolled in AP Chemistry. A curiosity about chemistry, encouragement from a respected teacher, or the simple fact that it was a requirement may have been your motivation. No matter what the reason, you find yourself flipping through a book, which promises to help you culminate this experience with the highest of honors, a 5 in AP Chemistry. Yes, it is possible to achieve this honor without this book. There are many excellent teachers of AP Chemistry out there who teach, coax, and otherwise prepare their students into a 5 every year. However, for the majority of students preparing for the exam, the benefits of buying this book far outweigh its cost.

The key to doing well on the Advanced Placement (AP) Chemistry Exam is to outline a method of attack and not to deviate from this method. We will work with you to make sure you take the best path towards the test. You will need to focus on each step, and this book will serve as a tool to guide your steps. But do not forget—no tool is useful if you do not use it.

## Organization of the Book

This book conducts you through the five steps necessary to prepare yourself for success on the exam. These steps will provide you with the skills and strategies vital to the exam, and the practice that will lead you to towards the perfect 5.

First, we start by introducing the basic five-step plan used in this book. Then in Chapter 1, we will give you some background information about the AP Chemistry exam. Next, in Chapter 2, we present three different approaches to preparing for the exam. In Chapter 3, we give you an opportunity to evaluate your knowledge with a Diagnostic Exam. The results of this exam will allow you to customize your study. In Chapter 4, we offer you a multitude of tips and suggestions about the different types of question on the AP Chemistry exam. Many times good test-taking practices can help raise your score.

Since the volume of the material to be mastered can be intimidating, Chapters 5 to 19 present a comprehensive review of the material that you will cover in an AP Chemistry course. This is review material, but since not all of this material appears in every AP Chemistry class, it will also help to fill in the gaps in your chemistry knowledge. You can use it in conjunction with your textbook if you are currently taking AP Chemistry, or you can use it as a review of the concepts you covered. At the end of each chapter, you will find both a multiple-choice and free-response exam for you to test yourself. The answers and explanations are included. This will also help you identify any topics that might require additional study.

After these content chapters, there are two complete chemistry practice exams, including multiple-choice and free-response questions. The answers and explanations are included. These exams will allow you to test your skills. The multiple-choice questions will provide you with practice on questions similar to those asked on past AP exams. These are not the exact questions, but ones that will focus you on the key AP Chemistry topics. There are also

examples of free-response questions; there are fewer of these, since they take much longer to answer. After you take an exam, you should review each question. Ask yourself, why was this question present? Why do I need to know this? Make sure you check your answers against the explanations. If necessary, use the index to locate a particular topic and reread the review material. We suggest that you take the first exam, identify those areas that need additional study, and review the appropriate material. Then take the second exam and use the results to guide your additional study.

Finally, in the appendixes you will find additional resources to aid your preparation. These include:

- Common conversions.
- How to balance Redox equations.
- A list of common ions.
- A bibliography.
- A number of useful Web sites.
- A glossary of terms related to AP Chemistry.
- A table of half-reactions for use while answering free-response questions.
- A table of equations and abbreviations for use while answering free-response questions.
- A periodic table for use when answering any exam questions.

## The Five-Step Program

### Step 1: Set Up Your Study Program

In Step 1, you will read a brief overview of the AP Chemistry exams, including an outline of the topics. You will also follow a process to help determine which of the following preparation programs is right for you:

- Full school year: September through May.
- One semester: January through May.
- Six weeks: Basic training for the exam.

### Step 2: Determine Your Test Readiness

Step 2 provides you with a diagnostic exam to assess your current level of understanding. This exam will let you know about your current level of preparedness, and on which areas you should focus your study.

- Take the diagnostic exam slowly and analyze each question. Do not worry about how many questions you get right. Hopefully this exam will boost your confidence.
- Review the answers and explanations following the exam, so that you see what you do and do not yet fully understand.

### Step 3: Develop Strategies for Success

Step 3 provides strategies that will help you do your best on the exam. These strategies cover both the multiple-choice and free-response sections of the exam. Some of these tips are based upon experience in writing questions, and others have been gleaned from our years of experience reading (grading) the AP Chemistry exams.

- Learn how to read and analyze multiple-choice questions.
- Learn how to answer multiple-choice questions, including whether or not to guess.
- Learn how to plan and write answers to the free-response questions.

### Step 4: Review the Knowledge You Need to Score High

Step 4 encompasses the majority of this book. In this step, you will learn or review the material you need to know for the test. Your results on the diagnostic exam will let you know on which material you should concentrate your study. Concentrating on some material does not mean you can ignore the other material. You should review all the material, even what you already know.

There is a lot of material here, enough to summarize a year long experience in AP Chemistry and highlight the, well, highlights. Some AP courses will have covered more material than yours, some will have covered less; but the bottom line is that if you thoroughly review this material, you will have studied all that is on the exam, and you will have significantly increased your chances of scoring well. This edition gives new emphasis to some areas of chemistry to bring your review more in line with the revised AP Chemistry exam format. For example, there is more discussion of reactions and the laboratory experience. Each topic contains one or more short exams to monitor your understanding of the current chapter.

### Step 5: Build Your Test-taking Confidence

In Step 5, you will complete your preparation by testing yourself on practice exams. This section contains *two* complete chemistry exams, solutions, and sometimes more importantly, advice on how to avoid the common mistakes. In this edition, the free-response exams have been updated to more accurately reflect the content tested on the AP exams. Be aware that these practice exams are *not* reproduced questions from actual AP Chemistry exams, but they mirror both the material tested by AP and the way in which it is tested.

## The Graphics Used in this Book

To emphasize particular skills and strategies, we use several icons throughout this book. An icon in the margin will alert you to pay particular attention to the accompanying text. We use these three icons:



This icon highlights a very important concept or fact that you should not pass over.



This icon calls your attention to a strategy that you may want to try.



This icon indicates a tip that you might find useful.

**Boldfaced** words indicate terms that are included in the glossary at the end of this book.

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# Set Up Your Study Program

CHAPTER 1 What You Need to Know About the AP Chemistry Exam

CHAPTER 2 How to Plan Your Time



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