

# AP<sup>®</sup>

# Barron's 化学2008

Barron's AP  
Chemistry 2008  
with CD-ROM  
4<sup>th</sup> Edition

- :: 备考指南 考点透析
- :: 3套诊断测试助您认清强弱项
- :: 5套全真测试题帮您考前热身

Neil D. Jespersen, Ph.D.

世界图书出版公司

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# Preface 前言

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**Y**ou are about to embark on one of the more intellectually challenging experiences of your life, the Advanced Placement Examination in Chemistry. Fewer than 1 percent of all high school students take this exam. Whatever the outcome, you are to be congratulated as one of a select group. As a conscientious student, you can use this review book to help you increase your score. A higher score can lead to college course credit and a head start in your selected career.

The AP Examination in Chemistry is different from other exams and tests that you have taken. *Explain*, *compare*, and *predict* are three important words often used on the AP Chemistry Exam. Remembered facts and calculation procedures are the basic groundwork of chemistry; however, high scores require a thorough understanding of chemical principles and relationships. Chemistry is rich in these relationships. The key to success on the exam is to think like a chemist and to apply your knowledge of one or more basic principles to provide a logical description of how chemicals behave.

This review book is designed with you, the student, in mind. It concentrates on the topics that are essential for a good score on the AP Chemistry Exam. In particular, the book is designed to provide insights into the use of basic principles to answer seemingly complex questions.

The discussion in each chapter is interspersed with exercises in which subject-matter problems are presented and solved. At the end of each chapter are questions to test your understanding of the topics discussed. These, together with the two diagnostic and three practice tests, provide hundreds of questions with a range of difficulty and complexity typical of an advanced placement exam. This review material will help you to pinpoint weak areas on which you need more preparation, and the explained answers can be used to identify sources of error or confusion.

# Acknowledgments 致谢

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**F**irst and foremost, a very special thank-you to my wife, Marilyn Zak Jespersen, who spent countless hours reading and correcting the manuscript and suggesting changes. Marilyn's contributions have made this book readable, understandable, and user-friendly. No other person could have been as dedicated to the work as she was.

I am grateful also to Professor James Brady for many fruitful discussions and ideas in the years we have been colleagues at St. John's. We share the idea that our job is not to teach chemistry but to excite students into learning it.

Finally, I thank the editors and reviewers for their suggestions and encouraging comments during the production of the book.

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# Introduction 绪论

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## IMPORTANT FACTS ABOUT THE ADVANCED PLACEMENT EXAMINATION IN CHEMISTRY

### 关于 AP 化学考试的重要信息

This examination is given in May each year at selected sites throughout the country. Exact dates, locations, and application forms are available in most guidance counselor offices. Information is also available from the following College Board Advanced Placement Program Offices.

#### **National Office** 全国办公室

Advanced Placement Program  
45 Columbus Avenue  
New York, NY 10023-6992  
212 713-8066  
E-mail: [ap@collegeboard.org](mailto:ap@collegeboard.org)

#### **Middle States Regional Office** 中部地区办公室

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San Jose, CA 95110-1051

866 392-4078

E-mail: wro@collegeboard.org

The Educational Testing Service has a web page at <http://www.collegeboard.org>. The web page for the advanced placement examination is <http://www.collegeboard.org/ap/chemistry/html/index001.html/>

Application forms and fees for the examination are usually due 1 month before the examination date. Late registration may not be accepted and a penalty fee is charged.

**TEST CONTENT AND DISTRIBUTION 考试内容和考点分布**

The material on the AP Chemistry Examination parallels the suggested course content for an AP course. The following lists topics and the approximate percentage of the exam devoted to each one. Note that this is not an exhaustive list of all possible topics, but it is a general guide.

**STRUCTURE OF MATTER (20%)**

## Atomic Theory and the Structure of the Atom

Evidence supporting the atomic theory

Atomic masses, atomic numbers, mass number, isotopes

Electronic structure of the atom

Energy levels, atomic spectra

Quantum numbers, atomic orbitals

Periodic trends and relationships

Ionization energies, electron affinities, electronegativity

Atomic and ionic radii, oxidation states

## Chemical Bonding

Inter- and intramolecular binding forces

Ionic and covalent bonding

Hydrogen bonds, dipole-dipole and van der Waals forces (including London forces)

Forces related to states, properties, and structure of matter

Bond polarity, electronegativity

## Models of molecules

Lewis structures, resonance

VSEPR

Valence bond theory, hybrid orbitals, sigma and pi bonds

## Molecular geometry, structural isomerism

Geometry of simple molecules, organic and inorganic

Coordination complexes

Dipole moments, molecular polarity

Relationship of properties to structure

## Nuclear Chemistry

Nuclear equations, radioactivity

Half-lives and applications

**STATES OF MATTER (20%)**

**Gases**

Laws of ideal gases

Ideal gas law (equation of state)

Partial pressures

Kinetic-molecular theory

Interpretation of gas laws

Avogadro's hypothesis

Relationship between kinetic energy and temperature

Deviations from ideal gases (real gases)

**Liquids and Solids**

Kinetic-molecular theory applied to liquids and solids

Phase diagrams of a pure substance, triple point, critical point

Changes of state

Structure of solids

**Solutions**

Types of solutions and solubility

Concentration units (normality is not tested)

Raoult's law

Colligative properties, osmosis

Nonideal behavior of solutions

**REACTIONS (35–40%)****Reaction Types**

- Acid-base reaction; Arrhenius, Brønsted-Lowry, and Lewis theories
- Coordination complexes and amphotericism
- Precipitation reactions
- Oxidation-reduction reactions
  - Oxidation number
  - Electron transfer in oxidation and reduction
  - Electrochemistry including electrolytic cells and Faraday's laws, galvanic cells and standard reduction potentials, Nernst equation prediction of the direction of a reaction

**Stoichiometry**

- Ionic and molecular species in chemical systems, net ionic equations
- Balancing equations including redox equations
- Mass and volume relationships using the mole concept, empirical formulas, and limiting reactants

**Equilibrium**

- Dynamic equilibrium concept, Le Châtelier's principle and equilibrium constants
- Quantitative use of equilibrium
  - Equilibrium constants for gas-phase reactions
  - Equilibrium constants for reactions in solutions
    - Acid-base equilibrium, and pH calculations
    - Solubility product calculations including common ions
    - Buffer and hydrolysis equilibria

**Kinetics**

- Rates of reaction, general concepts, and factors
- Determination of rates, rate laws, reaction order, and rate constants from experimental data including graphs
- Effect of temperature on rates
- Activation energy and catalysis
- Relationship of rate-determining step to rate laws and reaction mechanisms

**Thermodynamics**

- State functions
- First law of thermodynamics, enthalpy change, heats of formation and reaction, Hess's law, calorimetry
- Second law of thermodynamics including the concept of entropy, free energies of formation and reaction, the relationship between free energy, enthalpy, and entropy.
- Relationships between free energy change, equilibrium constants, and electrode potentials



**DESCRIPTIVE CHEMISTRY (10–15%)**

There are a large number of facts, principles, and concepts not listed above that will be needed to demonstrate a knowledge of chemistry on the AP Exam. In addition, the principles, concepts, and properties of chemicals are part of the real world outside the classroom. This should be a continuing part of the AP course. Some appropriate areas are

Chemical reactivity and reactions and a knowledge of chemical nomenclature

Relationships in the periodic table that allow prediction of chemical and physical properties. These can be horizontal, vertical, or diagonal relationships.

Organic chemistry, structures, functional groups, nomenclature, and chemical properties.

**LABORATORY (5–10%)**

College-level chemistry courses include laboratory exercises. These involve measurement, preparation of solutions, experimental setup, and synthesis and analysis of various compounds. The AP Exam will have questions involving the laboratory experience. Most of those questions involve general laboratory procedures, including

Making and recording appropriate observations of chemical substances and reactions

Making quantitative measurements and recording data appropriately

Calculating results from quantitative data and making appropriate interpretations of these results

Communicating the results of experiments in laboratory reports

**FORMAT OF THE EXAMINATION 考试形式**

The Advanced Placement Examination in Chemistry consists of two sections. Starting in 2007 the two parts of the exam, Section I and Section II are weighted equally (50 percent each) toward your overall score.

Section I is a 75-question, multiple-choice set of questions and is essentially the same as in past years in format and administration. You will have 90 minutes for this section, and calculators are NOT allowed. Any calculations will be simple mathematics that generally should not require a calculator. This section is designed to test the breadth of a student's knowledge of chemistry. Because each AP Chemistry course cannot possibly cover all possible topics, it is expected that there will be questions that you cannot possibly answer. No student is expected to know the answers to all of the multiple-choice questions.

Section II has been changed in several ways for May 2007. First, there will be no choice of questions to answer. All questions are required. The second change is in the traditional Question 4, where chemical equations must be written from word descriptions of the reactions. Starting this year, the chemical reactions question will require a balanced equation. Additionally, you will need to answer a short question