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# BARRON'S SAT II 化学

Subject Test Chemistry, With CD-ROM (第10版)

[美]马谢塔 (Joseph A. Mascetta) 编著

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[美]马谢塔(Joesph A. Mascetta)编著



世界图书出版公司

北京·广州·上海·西安

## 图书在版编目(CIP)数据

Barron's SAT II 化学 = Barron's SAT Subject Test Chemistry With CD-ROM : 英文/(美)马谢塔(Mascetta, J. A.)  
编著;余跃译. —第10版. —北京:世界图书出版公司北京公司, 2011.6  
ISBN 978-7-5100-3457-2

I. ①B… II. ①马… III. ①化学—高等学校—入学考试—美国—自学参考资料—英文 IV. ①O6

中国版本图书馆CIP数据核字(2011)第056684号

Barron's SAT Subject Test in Chemistry (10th Edition) By Joseph A. Mascetta

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## Barron's SAT II 化学(第10版)

原书名: Barron's SAT Subject Test in Chemistry, 10th Edition

编著者: [美] 马谢塔 (Joseph A. Mascetta)

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责任编辑: 张颖颖

出版: 世界图书出版公司北京公司

发行: 世界图书出版公司北京公司

(地址: 北京市朝内大街137号 邮编: 100010 电话: 64077922)

销售: 各地新华书店及外文书店

印刷: 三河市国英印务有限公司

开本: 880 mm × 1230 mm 1/16

印张: 33

字数: 624千

版次: 2011年6月第1版 2011年7月第2次印刷

版权登记: 京权图字01-2011-0569

ISBN 978-7-5100-3457-2/G · 460

定价: 63.00元(含1张CD-ROM)

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# Introduction: About the Test

## 入门：关于考试的基本信息

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**T**he College Board, which is a national nonprofit membership organization, sponsors the Admissions Testing Program (ATP). This group develops and administers the tests for the College Board and also prepares a booklet about the testing program, of which the SAT Subject Tests are a part. Copies of this booklet, which describes each of the SAT Subject Tests and gives sample questions, are automatically sent at the beginning of each academic year to secondary schools for free distribution to students who plan to register for the SAT Subject Tests. The name of this publication is *SAT Subject Tests Preparation Booklet*, and requests from schools or individuals about how to obtain free copies should be addressed to College Board SAT Program, P.O. 025505, Miami, FL 32102. The phone number (Monday–Friday) is (888) SAT-HELP, 8:30 a.m. to 9:00 p.m. Eastern Time; or you can order online at [www.collegeboard.com](http://www.collegeboard.com).

All of the SAT Subject Tests are contained in the same test booklet. Each takes 1 hour of testing time, and you may choose any one, two, or three tests to take at one sitting. They all consist of multiple-choice questions.

Many colleges require or recommend one or more Subject Tests for admission or placement. The scores are used in conjunction with your high school record, results on the SAT, teacher recommendations, and other background information to provide a reliable measure of your academic achievements and a good predication of your future performance.

In addition to obtaining a standardized assessment of your achievement from your scores, some colleges use the test results for placement into their particular programs in the freshman year. At others, advisers use the results to guide freshmen in the selection of courses.

### Is the SAT Subject Test in Chemistry Required?

必须参加SAT II 化学考试吗?

The best information on whether SAT Subject Tests are required and, if so, which ones is found in the individual college catalogs or a directory of colleges. Some colleges specify which tests you must take, while others allow you to choose. Obviously, if you have a choice and you have done well in chemistry, you should pick the SAT Subject Test in Chemistry as one of your tests. Even if the test is not required by the colleges to which you are applying, you can add the result to your



record to support your achievement level. The College Board publishes *The College Handbook*, which is a good source of information about colleges' requirements with regard to taking SAT Subject Tests. A copy of this book should be in your school library. You can also order it by using your registration form or by visiting the College Board's online store at [www.collegeboard.com](http://www.collegeboard.com).

### **When Should You Take the Test? 你该何时参加考试?**

You will undoubtedly do best if you take the test after completing the high school chemistry course or courses that you plan to take. At this time, the material will be fresh in your mind. Forgetting begins very quickly after you are past a topic or have finished the course. You should plan a review program for at least the last 6 weeks before the test date. (A plan is provided later in this book for such a review.) Careful review definitely helps—cramming just will not do if you want to get the best score of which you are capable!

Colleges that use SAT Subject Test results as part of the admissions process usually require that you take the test no later than December or January of your senior year. For early-decision programs, the test time is June of your junior year. Since chemistry is often a junior year course, June of that year is the optimum time to take the test.

### **When Is the Test Offered? 什么时间举办考试?**

The chemistry test is available every time the SAT Subject Tests are given, that is, on the first Saturday of October, November, December, May, and June. They are also given on the last Saturday of January. Be sure that the testing site for which you plan to register offers the SAT Subject Tests on each of these six times. Remember that you may choose to take one or two additional tests besides chemistry on any one test day. You do have to specify in advance which tests you plan to take on the test date you select; however, except for the Language Test with Listening, you may change your mind on the day of the test.

### **How Do You Register? 你如何注册?**

The *SAT Registration Bulletin* contains all the information you need to register and to have your scores sent to the college(s) of your choice. Copies of this publication should be available in every high school guidance office. If you have a problem getting one, write to College Board Admissions Testing Program (see the address on page vii) or go online to [www.collegeboard.com](http://www.collegeboard.com).

The deadline for registration is approximately one month before the test date.

### **How Should You Prepare for the Test? 你该如何准备考试?**

*Barron's SAT Subject Test in Chemistry* will be especially helpful. The more you know about the test, the more likely you are to get the best score possible for you. This book provides you with a diagnostic test, scoring information, four practice tests and the equivalent of one more test incorporated with the chapter review tests that allow you to become familiar with the question types and the wording of directions, and to gain a feel for the degree of emphasis on particular topics and the ways in which information may be tested. Each of these aspects should be consciously pursued as you use this book.



## What Topics Appear on the Test, and to What Extent?

考试会有哪些内容？难度如何？

The following charts show the content of the test and the levels of thinking skills tested:

Topics		Percent of test (Approx.)	Number of Questions (Approx.)
Structure of Matter	I. <u>Atomic theory and structure</u> , energy levels, quantum numbers, orbitals, electron configurations, periodic trends, nucleonics	25	21
	II. <u>Molecular structures</u> , shapes, Lewis structures, polarity		
	III. <u>Bonding</u> (ionic, covalent, metallic), relationships to properties and structures, inter-molecular forces, hydrogen bonding, London dispersion forces, dipole-dipole forces		
States of Matter	IV. <u>Gases</u> , kinetic molecular theory, gas law relationships, molar volume, density and related problems	16	14
	V. <u>Liquids and solids</u> , forces in these, types of solids, phase diagrams, phase changes		
	VI. <u>Solutions</u> ; molarity; molality; percent by mass; solubility factors for solids, liquids, and gases; colligative properties		

Topics		Percent of test (Approx.)	Number of Questions (Approx.)
<b>Reaction Types</b>	<p>VII. <u>Acids and bases</u>, including <u>Brønsted-Lowry theories</u>, strong and weak forms, pH, titration problems, indicators</p> <p>VIII. <u>Oxidation-reduction</u>, combustion, using oxidation numbers, use of activity series, <u>precipitation</u>, use of basic solubility rules</p>	14	12
<b>Stoichiometry</b>	<p>IX. <u>Mole concept</u>, molar mass, Avogadro's number, empirical and molecular formulas, <u>chemical equations</u>, balancing equations, solving related problems, determining yield, limiting factors</p>	14	12
<b>Equilibrium and Reaction Rates</b>	<p>X. <u>Equilibrium systems</u>, factors affecting, Le Châtelier's principle in gaseous and aqueous systems, constants, expressions, <u>rates of reactions</u>, factors affecting rates, activation energies, reaction diagrams</p>	5	4
<b>Thermochemistry</b>	<p>XI. <u>Conservation of energy</u>, calorimetry, specific heat, thermal curves, enthalpy changes, entropy (randomness) changes</p>	6	5

Topics		Percent of test (Approx.)	Number of Questions (Approx.)
Descriptive Chemistry	XII. <u>Physical and chemical properties</u> , nomenclature of elements, compounds, ions, properties and trends related to the periodic table, reactivity of elements and prediction of chemical reactions, examples of basic organic compounds, environmental concerns	12	10
	Laboratory	8	7
		Total Questions (85)	

Note: Each test contains approximately five questions on equation balancing and/or predicting products of chemical reactions. These are distributed among the various content categories.

Thinking Skills Tested	Percent of Test (approx.)
Recalling fundamental concepts, specific pieces of information, and basic terminology (low-level skill)	20
Showing a <i>comprehension of the basics</i> and the <i>ability to apply this information</i> in a rather straightforward manner to questions, situations, and the solution of qualitative or quantitative problem-oriented questions (medium-level skill)	45
Using the ability to <i>analyze</i> quantitative and/or qualitative data and to <i>synthesize</i> the knowledge learned to <i>evaluate</i> how and what ideas or relationships should be used to draw conclusions or to solve problems (high-level skill)	35

The first chart gives you a general overview of the content of the test. Your knowledge of the topics and your skills in recalling, applying, and synthesizing this knowledge are evaluated through 85 multiple-choice questions. This material is that generally covered in an introductory course in chemistry at a level suitable for college preparation. While every test covers the topics listed, different aspects of each topic are stressed from year to year. Add to this the differences that exist in high school courses with respect to the percentage of time devoted to each major topic and to the specific subtopics covered, and you may find that there are questions on topics with which you have little or no familiarity.

Each of the sample tests in this book is constructed to match closely the distribution of topics shown in the preceding chart so that you will gain a feel for the makeup of the actual test. After each test, a chart will show you which questions relate to each topic. This will be very helpful to you in planning your review because you can identify the areas on which you need to concentrate in your studies. Another chart enables you to see which chapters correspond to the various topic areas.

### **What General Information Should You Have About the Test?** 关于考试，你需要具备哪些常识？

1. A periodic chart is provided in this test as a resource and as the source of atomic numbers and atomic masses of the elements.
2. You will *not* be allowed to use an electronic calculator during the test.
3. Mathematical calculations are limited to simple algebraic and numerical ones.
4. You should be familiar with the concepts of ratios and of direct and inverse proportions, scientific notation, and exponential functions.
5. Metric system units are used in this test.
6. The test is composed of three types of questions as explained in the next section.

### **What Types of Questions Appear on the Test?**

#### 考试中会出现哪些类型的题目？

There are three general types of questions on the SAT Subject Test in Chemistry—matching questions, true/false and relationship analysis questions, and general five-choice questions. This section will discuss each type and give specific examples of how to answer these questions. You should learn the directions for each type so that you will be familiar with them on the test day. The directions in this section are similar to those on the test.

**TYPE 1. MATCHING QUESTIONS IN PART A.** In each of these questions, you are given five lettered choices that you will use to answer all the questions in that set. The choices may be in the form of statements, pictures, graphs, experimental findings, equations, or specific situations. Answering a question may be as simple as recalling information or as difficult as analyzing the information given to establish what you need to do qualitatively or quantitatively to synthesize your answer. The

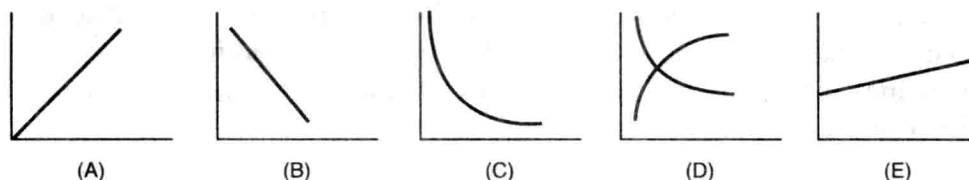
directions for this type of question specifically state that a choice may be used once, more than once, or not at all in each set.

## Part A A部分

**Directions:** Every set of the given choices below refers to the numbered statements or formulas immediately following it. Choose the one lettered choice that best fits each statement or formula and then fill in the corresponding oval on the answer sheet. Each choice may be used once, more than once, or not at all in each set.

### EXAMPLE 例示

Questions 1–3 refer to the following graphs:



1. The graph that best shows the relationship of volume to temperature for an ideal gas while the pressure is held constant
2. The graph that best shows the relationship of volume to pressure for an ideal gas while the temperature is held constant
3. The graph that best shows the relationship of the number of grams of solute that is soluble in 100 grams of water at varying temperatures if the solubility begins as a small quantity and increases slowly as the temperature is increased

These three questions require you to recall the basic gas laws and the graphic depiction of the relationship expressed in each law, as well as how solubility can be shown graphically.

To answer question 1, you must recognize that the relationship of gas volume to changes in temperature is a direct relationship that is depicted by graphing Charles's Law:  $V_1/T_1 = V_2/T_2$ . The only graph that shows that type of direct relationship with the appropriate slope is (A).

To answer question 2, you need to understand that Boyle's Law states that the pressure of a gas is inversely proportional to the volume at constant temperature. Mathematically, this means that pressure ( $P$ ) times volume ( $V$ ) is a constant, or  $P_1V_1 = P_2V_2$ . This inversely proportional relationship is accurately depicted in (C). Although (B) shows the values on the x-axis increasing as the y-axis values decrease, it does not fit the graph for an inverse proportion.

Question 3 requires that you have knowledge about solubility curves and can apply the solubility relationship given in words to graph (E).



**TYPE 2. TRUE/FALSE AND RELATIONSHIP QUESTIONS IN PART B.** On the actual SAT Subject Test in Chemistry, this type of question must be answered in a special section of your answer sheet labeled “chemistry.” Type 2 questions are numbered beginning with 101. Each question consists of a statement or assertion in column I and, on the other side of the word **BECAUSE**, another statement or assertion in column II. Your first task is to determine whether each of the statements is true or false and to record your answer for each in the answer blocks for column I and column II in the answer grid by darkening either the **(T)** or the **(F)** oval. Here you must use your reasoning skills and your understanding of the topic to determine whether there is a cause-and-effect relationship between the two statements.

Here are the directions and two examples of a relationship analysis question.

## Part B B部分

**Directions:** Every question below contains two statements, I in the left-hand column and II in the right-hand column. For each question, decide if statement I is true or false and if statement II is true or false and fill in the corresponding T or F ovals on your answer sheet. Fill in oval CE only if statement II is a correct explanation of statement I.

### Sample Answer Grid:

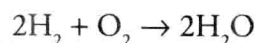
CHEMISTRY \* Fill in oval CE only if II is a correct explanation of I.

	I	II	CE*
101.	(T) (F)	(T) (F)	( )

### EXAMPLE 1 例1

101. When 2 liters of oxygen gas react completely with 2 liters of hydrogen gas, the limiting factor is the volume of the oxygen **BECAUSE** the coefficients in the balanced equation of a gaseous reaction give the volume relationship of the reacting gases.

The reaction that takes place is



The coefficients of this gaseous reaction show that 2L of hydrogen react with 1L of oxygen, leaving 1L of unreacted oxygen. The limiting factor is the quantity of hydrogen.

The ability to solve this quantitative relationship shows that statement I is not true. However, statement II does give a true statement of the relationship of coefficients in a balanced equation of gaseous chemical reaction. Therefore, the answer blocks would be completed like this:

	I	II	CE*
101.	<input type="radio"/> T <input checked="" type="radio"/> F	<input checked="" type="radio"/> T <input type="radio"/> F	<input type="radio"/>

### EXAMPLE 2 例2

102. Water is a good solvent of ionic and polar compounds      BECAUSE      the water molecule has polar properties due to the factors involved in the bonding of the hydrogen and oxygen atoms.

Statement I is true because water is such a good solvent that, as you have probably learned, it is sometimes referred to as the universal solvent. This property is attributed mostly to its polar structure. The polar covalent bond between the oxygen and hydrogen atoms and the angular orientation of the hydrogens at 105 degrees between them contribute to the establishment of a permanent dipole moment in the water molecule. This also gives rise to a high degree of hydrogen bonding. These properties combine to make water a powerful solvent for both polar and ionic compounds. Because of your familiarity with these concepts and the processes by which substances go into solution, you know that statement II not only is true but also is the reason that statement I is true. There is a cause-and-effect relationship between the two statements. Therefore, the answer blocks would be marked like this:

	I	II	CE*
102.	<input checked="" type="radio"/> T <input type="radio"/> F	<input checked="" type="radio"/> T <input type="radio"/> F	<input checked="" type="radio"/>

**TYPE 3: GENERAL FIVE-CHOICE QUESTIONS IN PART C.** The five-choice items in Part C are written usually as questions but sometimes as incomplete statements. You are given five suggested answers or completions. You must select the one that is best in each case and record your choice in the appropriate oval. In some questions you are asked to select the one inappropriate answer. Such questions contain a word in capital letters, such as NOT, LEAST, or EXCEPT.

In some of these questions, you may be asked to make an association between a graphic, pictorial, or mathematical representation and a stated explanation or problem. The solution may involve solving a scientific problem by correctly interpreting the representation. In some cases the same representation may be used for a series of two or more questions. In no case, however, is the correct answer to one question necessary for answering a subsequent question correctly. Each question in the set is independent of the others.



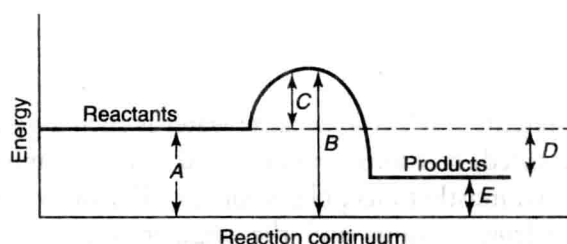
**Part C C部分**

**Directions:** Every question or incomplete statement below is followed by five suggested answers or completions. Choose the one that is best in each case and then fill in the corresponding oval on the answer sheet. Remember to return to the original part of the answer sheet.

**EXAMPLE 1 例1**

40. In this graphic representation of a chemical reaction, which arrow depicts the activation energy?

- (A) A  
(B) B  
(C) C  
(D) D  
(E) E



To answer this question, you need to know how to interpret the energy levels in this graphic representation of energy-level changes along the time continuum of the reaction. The activation energy is the minimum energy required for a chemical reaction to take place. The reactant molecules come together, and chemical bonds are stretched, broken, and formed in producing the products. During this process the energy of the system increases to a maximum, then decreases to the energy of the products. The activation energy is the difference between the maximum energy and the energy of the reactants. Choice (C) in the graphic depiction shows this energy barrier that has to be overcome for the reaction to proceed. The corresponding oval on the answer sheet should be darkened.

**EXAMPLE 2 例2**

41. If the molar mass of  $\text{NH}_3$  is 17 g/mol, what is the density of this compound at STP?
- (A) 0.25 g/L  
(B) 0.76 g/L  
(C) 1.25 g/L  
(D) 3.04 g/L  
(E) 9.11 g/L

The solution of this quantitative problem depends on the application of several principles. One principle is that the molar mass of a gas expressed in grams/mole will occupy 22.4 L at standard temperature and pressure (STP). The other is that the density of a gas at STP is the mass of 1 L of the gas. Therefore, 17 g of ammonia ( $\text{NH}_3$ ) will occupy 22.4 L, and 1 L is equal to 17 g/22.4 L or 0.76 g/L. The correct answer is (B).

**EXAMPLE 3 例3**

Some questions in this part are followed by three or four bits of information labeled by Roman numerals I through III or IV. One or more of these statements may correctly answer the question. You must select from the five lettered choices the one that best answers the question.

42. Which bond(s) is (are) ionic?

I. H-Cl (g)

II. S-Cl (g)

III. Cs-F (g)

(A) I only

(B) III only

(C) I and II only

(D) II and III only

(E) I, II, and III

To determine the type of bonding that exists in these three substances, you must use your knowledge of ionic bonds and the way they are formed. You must also use your knowledge of the relationship of the electronegativity of an element and the position of that element in the periodic chart. Compounds I and II are formed from elements that do not have enough difference in their respective electronegativities to cause the formation of an ionic bond. This can be inferred by checking the positions of the elements (H, Cl, and S) in the Periodic Table and noting how electronegativity varies with an element's position in the table. Compound III, cesium fluoride, consists of elements that appear in the lower right corner and the upper left corner, respectively, of the Periodic Table; therefore, the difference in their electronegativity values is sufficient so that an ionic bond can be predicted between them. Of the choices given, only (B) is a correct answer.

## How Can You Use This Book to Prepare for the Test?

你如何使用本书来准备考试?

The best way to use this book is a two-stage approach, and the next sections are arranged accordingly. First, you should take the diagnostic test. This will give you a preliminary exposure to the type of test you are planning to take, as well as a measure of how well you achieve on each of the three parts. You will also become aware of the types of questions that the test includes. Use the test-scoring information following the diagnostic test to determine your raw score and your strengths and weaknesses in the specific areas of the test.

Having taken the diagnostic test, you should then follow a study program. A study plan covering the 6 weeks before the test has been developed for you and is given in detail on page 35. It requires a minimum of 1 or 2 hours per night on weekdays but leaves your weekends free.