Barron's

原版引进

巴朗SAT Ⅱ化学

Subject Test Chemistry（第13版）

[美]马谢塔（Joseph A.Mascetta）
凯尼恩（Mark C.Kernion） 编著

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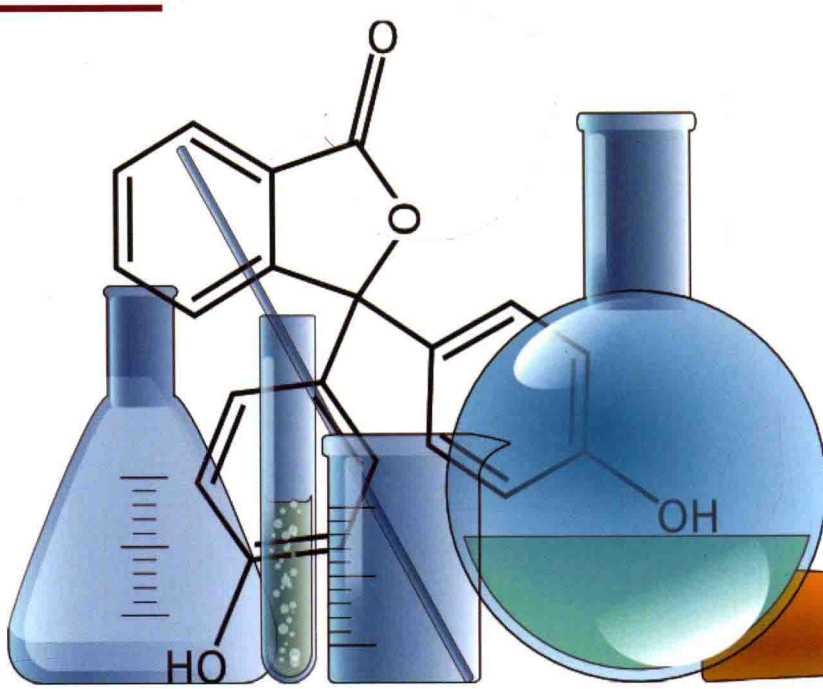

世界图书出版公司

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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 巴朗 SAT Ⅱ 化学：第13版 = Barron's SAT Subject Test Chemistry，13th Edition：英文 /（美）马谢塔（Joseph A. Mascetta），（美）凯尼恩（Mark C. Kernion）编著. —影印本. —北京：世界图书出版公司北京公司，2016. 11
ISBN 978-7-5192-2230-7

Ⅰ. ①B… Ⅱ. ①马… ②凯… Ⅲ. ①化学课—高等学校—入学考试—美国—教学参考资料—英文
Ⅳ. ①G634.83

中国版本图书馆CIP数据核字（2016）第 301236 号

原 书 名： Barron's SAT Subject Test Chemistry，13th Edition
编 著 者： ［美］马谢塔（Joseph A. Mascetta） 凯尼恩（Mark C. Kernion）
责任编辑： 陈晓辉

出版发行： 世界图书出版公司北京公司
地　　址： 北京市东城区朝内大街137号
邮　　编： 100010
电　　话： 010-64038355（发行） 64037380（客服） 64033507（总编室）
网　　址： http://www.wpcbj.com.cn
销　　售： 新华书店
印　　刷： 三河市国英印务有限公司
开　　本： 880 mm × 1230 mm 1/16
印　　张： 30
字　　数： 640千
版　　次： 2017年1月第1版 2017年1月第1次印刷
版权登记： 京权图字01-2016-9080
定　　价： 63.00（含1张CD-ROM）

Introduction: About the Test
入门：关于考试的基本信息

The SAT Subject Tests are given in specific subject areas to assess your academic abilities for college. They are prepared by the College Board and give evidence about your readiness in specific academic areas. The test can complement and enhance your college admission credentials. The introduction of this book will give you all the basic information you need to know about the subject test in chemistry. To learn additional information about this testing program, go to the website *sat.collegeboard.org/about-tests* and look under SAT Subject Tests.

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.

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.

When Should You Take the Test? 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 latest test time is June of your junior year. The optimum time to take the test is the June test date of the year you take your last chemistry class in high school. At that time, the material you learned will be the easiest to recollect, and your preparations will likely correspond with the final exam in that course.

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. Keep in mind that the SAT Test and the SAT Subject Test in Chemistry can't be taken on the same day.

How Do You Register? 你如何注册?

You may get all of your registration information by going to *sat.collegeboard.org/register*. This is the quickest and easiest way to register for the test. This site will give you all the information you need to complete your registration. You can choose your test date and center as well as receive immediate registration confirmation. This website also gives you instructions for how to register by mail.

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 very 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. You will get a feeling 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		25	21
	I. Atomic theory and structure, energy levels, quantum numbers, orbitals, electron configurations, periodic trends II. Molecular structures, shapes, Lewis structures, polarity, three-dimensional shapes III. Bonding (ionic, covalent, metallic), relationships to properties and structures, intermolecular forces, hydrogen bonding, London dispersion forces, dipole-dipole forces		

	Topics	Percent of Test (Approx.)	Number of Questions (Approx.)
States of Matter		16	14
	IV. Gases, kinetic molecular theory, gas law relationships, molar volume, density and related problems V. Liquids and solids, forces in these, types of solids, phase diagrams, phase changes VI. Solutions; molarity; percent by mass; solution preparation and related problems, solubility factors for solids, liquids, and gases; qualitative aspects of colligative properties		
Reaction Types		14	12
	VII. Acids and bases, including Brønsted-Lowry theories, strong and weak forms, pH, titration problems, indicators VIII. Oxidation-reduction, combustion, using oxidation numbers, use of activity series, precipitation, use of basic solubility rules		
Stoichiometry		14	12
	IX. Mole concept, molar mass, Avogadro's number, empirical and molecular formulas, chemical equations, balancing equations, solving related problems, determining percent yield, limiting factors		
Equilibrium and Reaction Rates		5	4
	X. Equilibrium systems, factors affecting, Le Châtelier's Principle in gaseous and aqueous systems, equilibrium constants, expressions, rates of reactions, factors affecting rates, activation energies, reaction diagrams		
Thermochemistry		6	5
	XI. Conservation of energy, calorimetry, specific heat, thermal curves, enthalpy (heat) changes, entropy (randomness) changes		

	Topics	Percent of Test (Approx.)	Number of Questions (Approx.)
Descriptive Chemistry		12	10
	XII. Physical and chemical properties, 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		
Laboratory		8	7
	XIII. Laboratory safety rules, nomenclature, use of equipment, making measurements and observations, data to analyze, interpreting graphical data, drawing conclusions		
			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 *comprehension of the basics* and the *ability to apply this information* 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 *analyze* quantitative and/or qualitative data and to *synthesize* the knowledge learned to *evaluate* 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.

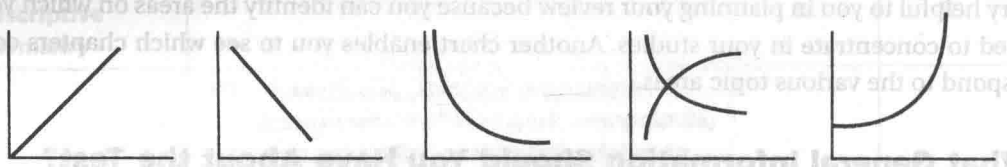
TYPE 1. MATCHING QUESTIONS IN PART A. In each of these questions, you are given five lettered choices that you will use to answer all the questions in that set. The choices may be in the form of statements, pictures, graphs, experimental findings, equations, or specific situations. Answering a question 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

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 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 as a hyperbola 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 ANALYSIS 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 Ⓣ or the Ⓕ oval. Here you must use your reasoning skills and your understanding of the topic to determine whether there is a causal relationship between the two statements.

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

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

101. When 2 liters of oxygen gas react completely with 2 liters of hydrogen gas, the limiting reactant is 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

$$2H_2 + O_2 \rightarrow 2H_2O$$

The coefficients of this gaseous reaction show that 2 L of hydrogen react with 1 L of oxygen, leaving 1 L of oxygen unreacted, or in excess. The limiting reactant, then, 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.	(T) (F)	(T) (F)	◯

Example 2

102. Water is generally a good solvent of ionic and polar molecular 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 for these types of compounds 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. 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 causal relationship between the two statements. Therefore, the answer blocks would be marked like this:

	I		II		CE*
102.	T	F	T	F	

As a test-taking tip, it should be noted that if statement I or II is false, the oval for CE should *never* be filled in. Therefore, the only time CE could *possibly* be filled in is if statements I and II are both marked true.

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.

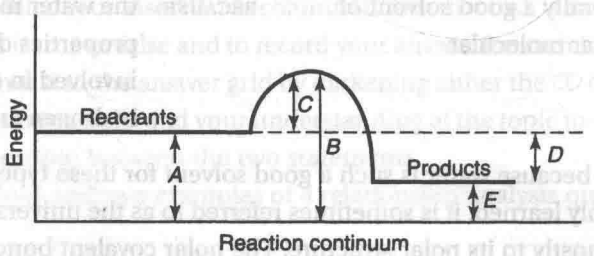
PART C: CHEMISTRY

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

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

41. If the molar mass of 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 density is defined as the mass of a substance divided by the volume it occupies. Therefore, 17g of ammonia (NH_3) will occupy 22.4 L at STP. So the density of the NH_3 is 17 g/22.4 L or 0.76 g/L. The correct answer is (B).

➥ Example 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) considered predominantly 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 the way in which bonds 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 Table. 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 32. It requires a minimum of 1 or 2 hours per night on weekdays but leaves your weekends free.

Five Steps to Improve Your Problem-Solving Skills*
提高解题技巧的五个步骤

Chemistry is a subject that deals with many problem situations that you, the student, must be able to solve. Solving problems may seem to be a natural process when the degree of difficulty is not very great, and you may not need a structured method to attack these problems. However, for complex problems an orderly process is required.

The following is such a problem-solving process. Each step is vital to the next step and to the final solution of the problem.

- STEP 1 Clarify the problem: to separate the problem into the facts, the conditions, and the questions that need to be answered, and to establish the goal.
- STEP 2 Explore: to examine the sufficiency of the data, to organize the data, and to apply previously acquired knowledge, skills, and understanding.
- STEP 3 Select a strategy: to choose an appropriate method to solve the problem.
- STEP 4 Solve: to apply the skills needed to carry out the strategy chosen.
- STEP 5 Review: to examine the reasonableness of the solution through estimation and to evaluate the effectiveness of the process.

The steps of the problem-solving process listed above should be followed in sequence. The subskills listed below for each step, however, are not in sequence. The order in which subskill patterns are used will differ with the nature of the problem and/or with the ways in which the individual problem solver thinks. Also, not every subskill need be employed in solving every problem.

**Adapted with permission from* Thinking Skills Resource Guide, *a noncopyrighted publication of Mount Lebanon School District, Pittsburgh, PA.*

1. **CLARIFY THE PROBLEM**
   a. Identify the facts. What is known about the problem?
   b. Identify the conditions. What is the current situation?
   c. Identify the questions. What needs to be answered before the problem can be solved?
   d. Visualize the problem.
      1. Make mental images of the problem.
      2. If desirable or necessary, draw a sketch or diagram, make an outline, write down symbols or equations that correspond to the mental images.
   e. Establish the goal. The goal defines the specific result to be accomplished through the problem-solving process. It defines the purpose or function the solution is expected to achieve and serves as the basis for evaluating the solution.
2. **EXPLORE**
   a. Review previously acquired knowledge, skills, and understanding. Determine whether the current problem is similar to a previously seen type.
   b. Estimate the sufficiency of the data. Does there seem to be enough information to solve the problem?
   c. Organize the data. There are many ways in which data can be organized. Some examples are outline, written symbols and equations, chart, table, graph, map, diagram, and drawing. Determine whether the data organized in the way(s) you have chosen will enable you to partially or completely solve the problem.
   d. Determine what new data, if any, need to be collected. What additional information may be needed to solve the problem? Can the existing data be reorganized to generate new information? Do other resources need to be consulted? This step may suggest possible strategies to be used to solve the problem.
3. **SELECT A STRATEGY**

A strategy is a goal-directed sequence of mental operations. Selecting a strategy is the most important and also the most difficult step in the problem-solving process. Although there may be several strategies that will lead to the solution of a problem, the skilled problem solver uses the most efficient strategy. The choice of the most efficient strategy is based on knowledge and experience as well as a careful application of the clarify and explore steps of the problem-solving method. Some problems may require the use of a combination of strategies.

The following search methods may help you to select a strategy. They do not represent all of the possible ways in which this can be done. Other methods of strategy selection are related to specific content areas.

a. Trial-and-error search: Such a search either doesn't have or doesn't use information that indicates that one path is more likely to lead to the goal than any other path.

Trial-and-error search comes in two forms, blind and systematic. In *blind search*, the searchers pick paths to explore blindly, without considering whether they have already explored these paths. A preferable method is *systematic search*, in which the searchers keep track of the paths they have already explored and do not duplicate them. Because this method avoids multiple searches, systematic search is usually twice as efficient as blind search.

b. Reduction method: This involves breaking the problem into a sequence of smaller parts by setting up subgoals. Subgoals make problem solving easier because they reduce the amount of search required to find the solution.

You can set up subgoals by working part way into a problem and then analyzing the partial goal to be achieved. In doing this, you can drop the problem restrictions that do not apply to the subgoal. By adding up all the subgoals, you can solve the "abstracted" problem.

c. Working backward: When you have trouble solving a problem head-on, it is often useful to try to work backward. Working backward involves a simple change in representation or point of view. Your new starting point is the original goal. Working backward can be helpful because problems are often easier to solve in one direction than another.

d. Knowledge-based method: This strategy uses information stored in the problem solver's memory, or newly acquired information, to guide the search for the solution. The problem solver may have solved a similar problem and can use this knowledge in a new situation. In other cases, problem solvers may have to acquire needed knowledge. For example, they may solve an auxiliary problem to learn how to solve the one they are having difficulty with.

Searching for analogous (similar) problems is a very powerful problem-solving technique. When you are having difficulty with a problem, try to pose a related, easier one and hope thereby to learn something that will help you solve the harder problem.

4. SOLVE

Use the strategy chosen to actually solve the problem. Executing the solution provides you with a very valuable check on the adequacy of your plan. Sometimes students will look at a problem and decide that, since they know how to solve it, they need not bother with the drudgery of actually executing the solution. Sometimes the students are right, but at other times they miss an excellent opportunity to discover that they were wrong.

5. REVIEW/VERIFY WITH ESTIMATION

a. Evaluation. The critical question in evaluation is this: "Does the answer I propose meet all of the goals and conditions set by the problem?" Thus, after the effort of finding a solution, you must turn back to the problem statement and check carefully to be sure your solution satisfies it.

With easy problems there is a strong temptation to skip evaluation because the probability of error seems small. In some cases, however, this can be costly. Evaluation may prove that errors were present.

b. Verification of the reasonableness of the answer. It is easy to become so involved with the process and mathematics of a problem that an answer is recorded that is totally illogical. To avoid this mistake, you should simplify the numbers involved and solve for an answer. Having done this, compare your estimated result with your answer to ensure that your answer is feasible.

For example, a problem requires the following operations:

$$5.12 \times 10^5 \times 3.98 \times 10^6 \text{ divided by } 910$$

And doing all the math, you get an answer of

$$0.02239 \times 10^{11} \text{ or } 2.24 \times 10^9$$

To estimate the answer, first simplify the numbers to one significant figure (significant figures are discussed in Chapter 1). This gives

$$5 \times 10^5 \times 4 \times 10^6 \text{ divided by } 9 \times 10^2$$

which is

$$20 \times 10^{11} \text{ divided by } 9 \times 10^2 = 2.2 \times 10^9$$

This is the estimated answer, which validates the answer above.

When you are dealing with test items that provide multiple-choice answers, you can often use estimation to arrive at the answer without doing the more complicated mathematics.

c. Consolidation. Here the basic question to be answered is: "What can I learn from the experience of solving this problem?" The following more specific questions may help you to answer this general one:

1. Why was this problem difficult?
2. Was it difficult to follow a plan?
3. Was it difficult to decide on a plan? If so, why?
4. Did I take the long way to the answer?
5. Can I use this plan again in similar problems?

The important thing is to reflect on the process that you used in order to make future problem solving easier.

CHEMISTRY TEST

Material in the following table may be useful in answering the questions in this examination

Periodic Table of the Elements

1 H 1.0078																	2 He 4.0026
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 16.00	9 F 19.00	10 Ne 20.179
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.938	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (281)	111 Rg (272)	112 Cn (285)						

*Lathanides Series	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
†Actinides Series	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

USE THIS PERIODIC TABLE WITH ALL THE PRACTICE TESTS.