

Barron's

原版
引进

巴朗 SAT II 物理

(第2版)

Barron's SAT Subject
Test in Physics (2nd Edition)

[美] 罗伯特·詹森 (Robert Jansen, M.A.) 编著
格雷格·杨 (Greg Young, M.S.)

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Introduction 介绍

The SAT Subject Test in Physics is designed to assess the outcome of completing a college-preparatory physics course in high school. Although state and course requirements for physics may vary, all college-preparatory physics courses should address certain core topics and principles. The SAT Subject Test in Physics focuses on this common ground. The goal of this book is to review the main topics and concepts that are likely to appear on the SAT Subject Test in Physics and help you prepare for the exam.

USING THIS RESOURCE EFFICIENTLY 有效地利用资源

The chapters are organized to maximize the effectiveness of your study time. Each chapter begins with a summary of the topics to be covered, bulleted points of the major topics, and a list of new variables discussed in the chapter. The body of the chapter includes a discussion of the topics along with relevant example questions. Each chapter also includes a unique “What’s the Trick?” approach to help you solve the questions quickly and effectively. The margins contain tips called “If You See . . .” which point out some of the major insights into critical topics and difficult concepts. The end of the chapter contains a bulleted summary along with a table grouping the critical “If You See . . .” elements as a concentrated review. Each chapter is followed by multiple-choice practice questions with answers and explanations.

QR codes appear in the margins throughout the text, next to key examples. Each QR code links to an online video explanation of the example problem it is associated with. The QR code in the margin of this page is linked to the table of contents for all of the videos available for this text. The available video sequences solve selected example problems in a dynamic manner.

In addition to the chapters that review the exam content, the book includes four complete practice exams. The first practice exam should be used as a diagnostic test to assess your current level of understanding of the subject matter and to establish a baseline score to improve upon. Ideally, you should take this first diagnostic examination using the same guidelines as an actual SAT Subject Test in Physics:

- Time limit of 1 hour for 75 multiple-choice questions.
- NO calculators allowed.
- No physics formula sheet is allowed, and none will be provided.
- Correct answers receive 1 point.
- Subtract $\frac{1}{4}$ point for each incorrect answer.
- Answers left blank receive 0 points.

**Table of Contents
for Video Example
Problems**



A complete list of test-taking parameters and how to find your approximate raw score is provided near the end of this introduction. You should take the other three examinations after you have completed all or portions of your review.

Different students will approach this review in a variety of ways. Some may choose to work methodically through each chapter, which will require starting well before the actual exam date and setting aside adequate review time. Students with limited time may decide to read the important “If You See . . .” tips in the margins and attempt the end-of-chapter questions to determine if they should study a particular chapter in depth. Keep in mind that each chapter builds on the material from previous chapters. Skimming the material too quickly, especially in chapters containing key foundational material, can result in errors throughout the entire exam. Remember these helpful tips as you use this review book:

- Start reviewing the material well before the exam date. Set aside an hour or two each day to read through the chapters. Trying to cram in all the information at once is not as effective as reviewing smaller portions over time.
- Solve the practice problems as though they are an actual exam. Merely reading the solutions without actually attempting to solve the problems will not help you to understand the material.
- Being able to visualize the events described in an exam question is a valuable skill in physics. Students who construct diagrams to represent the situations described in physics problems tend to earn better scores on the exam.
- Some questions require you to recall facts, and others require you to understand concepts and principles. Many involve the use or understanding of formulas without complicated arithmetical calculations. Calculators are *not* allowed on the examination, and a list of formulas is *not* provided. Therefore, memorizing key physics formulas and having a working knowledge of how to manipulate variables are crucial for success.

THE PHYSICS EXAM 物理考试

A complete outline of the contents of the SAT Subject Test in Physics can be obtained from the College Board’s website at <http://sat.collegeboard.org>. The College Board, which writes and administers the examination, does not publish copies of former examinations. However, they do offer sample questions on their website.

All questions are multiple-choice and have five answer choices. The practice tests and sample questions in this book reflect both the content and the question formats found on the SAT Subject Test in Physics. The exam tests students’ knowledge in 6 topics.

The content and approximate percentage of the test devoted to that content is as follows:

Mechanics—Approximately 40% (~30 questions)

力学——约占40% (30道题)

- **Kinematics:** may include velocity, acceleration, motion in one dimension, projectile motion, and graphical analysis.
- **Dynamics:** may include force, Newton’s laws, static equilibrium, vectors, circular motion, centripetal force, universal gravitation, Kepler’s laws, and simple harmonic motion such as pendulums and mass on a spring.
- **Energy and momentum:** may include potential and kinetic energy, work, power, impulse, momentum, conservation of energy, and conservation of momentum.

Electricity and Magnetism—Approximately 20% (~15 questions)

电学和磁学——约占20% (15道题)

- **Electrostatics:** may include Coulomb's law, induced charge, electric fields, electric potential, electric potential difference, electric potential energy, and parallel plate capacitors.
- **Circuits:** may include solving for series and/or parallel circuits involving resistors and lightbulbs, Ohm's law, and Joule's law.
- **Magnetism:** may include permanent magnets, Faraday's law, Lenz's law, magnetic fields created by moving charges, currents created by changing magnetic fields, forces on charges in magnetic fields, and the right-hand rule.

Waves and Optics—Approximately 20% (~15 questions)

波和光学——约占20% (15道题)

- **General aspects of waves:** may include wave speed, frequency, wavelength, amplitude, the affect of the medium on wave properties, superposition, standing waves, and Doppler effect.
- **Ray optics:** may include reflection, refraction, Snell's law, ray tracing as it pertains to pinholes, mirrors, and lenses.
- **Physical optics:** may include single-slit diffraction, double-slit interference, polarization, and color.

Heat and Thermodynamics—Approximately 8% (~6 questions)

热量和热力学——约占8% (6道题)

- **Thermal properties:** may include temperature, heat, heat transfer, specific and latent heats of fusion and vaporization, changes in state, and thermal expansion.
- **Laws of thermodynamics:** may include first and second laws of thermodynamics, entropy, internal energy, heat engines, and efficiency.

Modern Physics—Approximately 8% (~6 questions)

近代物理——约占8% (6道题)

- **Quantum and atomic phenomena:** may include Rutherford and Bohr models of the atom, energy levels, atomic spectra, photons, and the photoelectric effect.
- **Nuclear physics:** may include fundamental particles, radioactivity, nuclear reactions, half-life, fission, and fusion.
- **Relativity:** may include length contraction, speed of light, time dilation, and mass-energy equivalence.

Miscellaneous—Approximately 4% (~3 questions)

其他——约占4% (3道题)

- **General:** may include the history of physics and important persons in the development of physics.
- **Analytical skills:** may include graphical analysis, measurement, and math skills as related to the topics covered.
- **Contemporary physics:** may include astronomy, superconductivity, and current events in the world of physics.

Format of the SAT Subject Examination in Physics SAT II 物理考试格式

The following bulleted list describes the overall format of the SAT Subject Test in Physics.

- The test is 1 hour and consists of 75 multiple-choice questions.
- NO calculators are allowed on the test.
- A list of physics formulas is *not* provided on the examination.
- To simplify calculations, $g = 10 \text{ m/s}^2$ is used in all such problems.
- The total score for the test is reported on a 200-to-800 point scale.
- There is a $\frac{1}{4}$ point deduction for any incorrect answers marked.

Raw Score and Approximate Scaled Score 原始分数和换算分数

After you have taken one of the practice tests included in this book, you will want to determine your raw score. To do so, use the following formula:

$$\text{Raw score} = \# \text{ Correct} - (\# \text{ Incorrect} \times \frac{1}{4}) = \underline{\hspace{2cm}}$$

Multiply by $\frac{1}{4}$ the number of questions answered incorrectly. This is known as the “guessing penalty.” Do not deduct points for unanswered, blank questions. Questions that are left blank receive 0 points.

Scaled scores vary from test session to test session, so there is no accurate way to predict what raw score will produce a particular scaled score. However, raw scores between 65 and 75 will typically qualify for a scaled score of around 800, and a raw score of 45 will usually qualify for a scaled score of around 700.

Although colleges do not publish their SAT Subject Test admission data, it is fairly safe to assume that a score of 700 or better on any SAT Subject Test is considered to be an excellent score. Admission to any university is a complicated process and encompasses many factors, one of which can be the SAT Subject Test scores.

GENERAL EXAMINATION STRATEGIES 总的考试策略

Multiple-choice exam questions in physics often involve many elements simultaneously. They require students to know definitions, concepts, and how variables are mathematically related. In addition, the answer choices include well thought out distracters. Use the following exam strategies to help overcome these challenges.

Write on the Exam 答题

You are allowed to write on the exam booklet. Use this to your advantage.

- 1. WHEN READING A DIFFICULT PROBLEM, UNDERLINE OR CIRCLE WHAT THE QUESTION IS ASKING FOR.** When you choose an answer, make sure it answers what the question is looking for and is not a partial answer. Example: Students are often tricked into choosing an answer that describes velocity, when the question actually asks for the trend in acceleration.
- 2. DRAWING A SKETCH IS EXTREMELY ADVANTAGEOUS.** When in doubt, making a quick sketch of the problem always improves the odds of arriving at a correct answer.

3. IN COMPLEX PROBLEMS, MAKE A LIST OF VARIABLES. Doing this turns a word problem into a math problem. Be aware of hidden variables. These are often zero quantities hidden in the language of the problem. Example: The phrase “constant velocity” is a way of indicating that acceleration is zero.

4. WRITE DOWN FORMULAS DURING THE EXAM. Doing this will help you avoid making silly errors when solving mathematical problems. It also helps you determine more easily the relationships among variables in conceptual problems.

Make Educated Guesses 猜题

Should you guess? This is a good question that is best answered while completing the practice tests. There are ways you can improve the odds of choosing a correct answer, and there are ways to figure out if guessing is wise or not.

1. IF YOU ARE ABLE TO IDENTIFY OBVIOUS INCORRECT ANSWERS, CROSS THEM OUT IN THE EXAM BOOKLET. If a correct answer does not immediately present itself, then eliminate obviously wrong answers. Simply cross them out.

2. USUALLY YOUR FIRST IMPULSE IS CORRECT. When you cannot decide between two answers, your first choice is most often correct. If you reconsider your first choice and change the answer, you may likely change a correct answer into a wrong answer. Statistically, it is safer to keep the original answer when undecided between two possible answers. However, if you revisit a problem and are certain that you answered it incorrectly, changing an answer is a must.

3. THERE IS A WAY TO DETERMINE IF ANSWERING QUESTIONABLE PROBLEMS IS WISE. While taking each practice exam, circle any answers on the answer sheet that required you to guess. At the end of the exam, score these problems separately, giving 1 point for each correct answer and subtracting a $\frac{1}{4}$ of a point for each incorrect answer. If the outcome is a positive score, then the strategies you are using to guess are paying off. However, if the outcome is negative, you should not guess.

4. BEFORE TAKING THE NEXT PRACTICE EXAM REVIEW THE PROBLEMS WITH INCORRECT ANSWERS OR THOSE THAT REQUIRED GUESSING. It may be wise to record all the corrections for missed and guessed questions in one place. Using index cards or Cornell notes are ideal methods of recording a difficult question followed by the essential knowledge that leads to the correct solution. Study and review this information before taking the next practice exam and before taking the actual subject test.

Physics questions can be very challenging. For many students, improvement is a process that gets easier with each practice exam. Attempting problems and developing awareness of your own strengths and weaknesses is the key to future success. Making mistakes is not a problem as long as you make a determined effort to learn from them.