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# AP 物理 1&2

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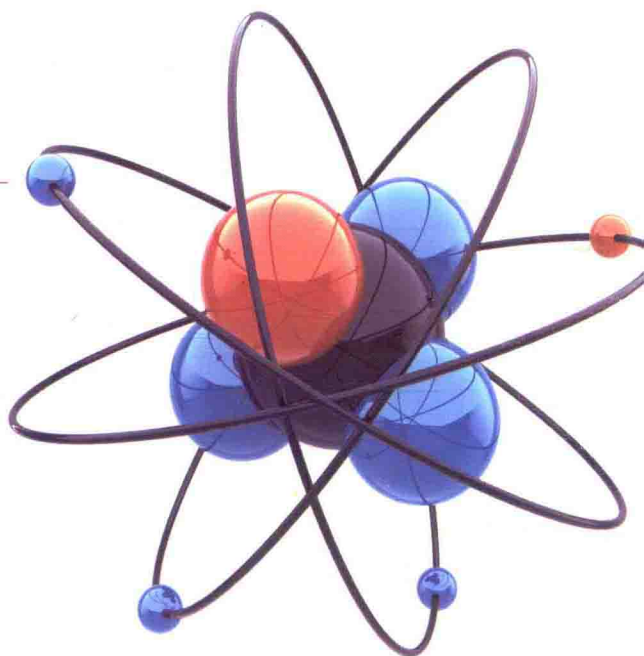
[美] 赖德奥特 (Kenneth Rideout) 沃夫 (Jonathan Wolf) 编著

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As you review the content in this book to work toward earning that **5** on your AP Physics 1 exam, here are five things that you **MUST** know above everything else.

# Barron's Essential (AP Physics 1)

1

## Know your kinematics:

- Know the difference between velocity and speed, displacement and distance.
- Know to use equations of motion only for problems involving constant acceleration and to otherwise use graphical methods to analyze the kinematics.
- Find hidden information within the problem (initial or final speeds of zero, accelerations of  $9.8 \text{ m/s}^2$ ).
- Keep your  $x$ - and  $y$ -motions separate: the only connecting variable is time.

2

## Know your dynamics:

- Start all analyses with a free-body diagram.
- Align your coordinate system with the direction of acceleration (if known).
- Be alert for situations that require a net force but no corresponding change in speed (centripetal forces).
- Do not add additional forces in an ad hoc manner. Decide on the number of forces based on the object's interactions, not its motion.

3

## Know your conservation laws:

- If all the masses and motions of interacting particles are specified, conserve the net values of energy, momentum, and angular momentum.
- If the object in question is interacting with an object whose masses and motions are unspecified, then use the interactions to calculate changes in "conserved" quantities.
- When using conservation of energy, be alert to work done by nonconservative forces.
- When using conservation of momenta, remember that both linear and angular momenta are vector quantities.

4

## Look for cross-cutting questions:

- This exam is designed to probe for your understanding of the connections between the various topics covered in a first year physics class. It is not enough to be able to solve the "classic" problem types. You must be able to solve multi-tiered problems (e.g., apply conservation of angular momentum and dynamics at the same time within one problem).

5

## Understand the underlying concepts:

- Many of the questions are concept-focused. Be sure to understand how to explain the why's, not just to calculate a numerical solution.

As you review the content in this book to work toward earning that **5** on your AP Physics 2 exam, here are five things that you **MUST** know above everything else.

**1 Master the Essential 5 listed for the AP Physics 1 Exam.** These provide the essential knowledge base for the material in this second-year course.

**2 Understand fields:**

- Be able to visualize, draw, and interpret the major fields: gravitation, electric, and magnetic.
- Be able to make analogies between electric and gravitational fields.
- Understand the difference between the field strengths and the actual force exerted on an object in that field.
- Understand the differences between field potentials and the actual potential energy present when an object is in the field.

**3 Know how and when to use the various models for light:**

- Model light and all electromagnetic radiation as a wave for interactions such as diffraction and interference, and when describing it in terms of amplitude and wavelength.
- Model light as a series of wave-front rays for problems in optics (reflection, refraction, mirrors, and lenses).
- Model light as individual particles (photons) in atomic and modern physics.

**4 Understand the limiting cases for capacitors in simple and complex circuits:**

- Although detailed questions about the exponential nature of charging and discharging capacitors will not be asked, you must understand their behavior and purpose when fully charged or fully discharged in circuits.

**5 Understand the energy conservation roots of thermodynamics and fluid dynamics:**

- Understand the specialized vocabulary of thermodynamics and be able to connect all operations to energy transfers and transformations.
- Be able to go back and forth between the macroscopic descriptions of fluids with their microscopic behavior.

# PREFACE

## 前言

In this review book, you will find all the material needed to review and prepare for two different AP Physics exams: AP Physics 1 (a first-year precalculus course in physics) and AP Physics 2 (a second year of precalculus physics). Each chapter has review questions that vary in style and level of difficulty. These are intended to test your level of understanding of the review material. Some of these chapter questions may be easier, harder, or of a slightly different style from the actual AP exam as they are limited to the content of that particular chapter. The tests, on the other hand, are broad in scope and draw from several different content areas at once. At the end of this book are several full-length practice tests that mirror the actual AP exams in style, content, and difficulty. All questions have full solutions and explanations provided.

Before the review chapters are two diagnostic exams (one each for AP Physics 1 and AP Physics 2). They can be used for practice or to guide you specifically to certain content areas you may need to review before the test. Additional problem-solving strategies are provided throughout the book.

The majority of the review content of this book is drawn from the existing book by Jonathan Wolf written for the (now-retired) AP Physics B exam. With all of the changes in scope, sequence, focus, and style, I am grateful to both him and our editor at Barron's Educational Series, Linda Turner, for the opportunity to assist in this overhaul and transformation of the AP Physics B materials into this new AP Physics 1 and 2 book. Most important, I want to thank my wife, Irene, for her support throughout this project.

Ken Rideout  
Wayland, Massachusetts  
July 2014

# 目 录

## 巴朗五点学习提要

AP物理1..... xv

AP物理2..... xvii

前言..... xix

导论..... 1

学习技巧和提示..... 3

## 诊断测试

AP物理1..... 17

答案..... 24

答案解析..... 25

AP物理2..... 35

答案..... 44

答案解析..... 45

## 复习和练习

1 AP物理概念总述..... 53

七大想法..... 53

客体 and 系统..... 53

基本粒子..... 54

2 矢量..... 55

坐标系和参考系..... 55

矢量..... 56

矢量加法..... 57

矢量减法..... 60

运用分矢量做加法..... 61

练习题..... 63

3 运动学..... 69

平均和瞬时运动..... 69

加速度..... 71

自由落体运动	74
运动的图像分析	76
相对运动	78
平抛运动	79
斜抛运动	81
匀速圆周运动	83
练习题	85
<b>4 力和牛顿运动定律</b>	<b>95</b>
力	95
牛顿运动定律	97
牛顿定律的静态应用	99
牛顿定律的动态应用	102
有心力	102
摩擦力	103
练习题	108
<b>5 能</b>	<b>119</b>
功	119
功率	122
动能和功能定律	122
势能和保守力	124
能量守恒和系统	124
练习题	128
<b>6 振荡运动</b>	<b>135</b>
弹簧振子的简谐运动	135
单摆的简谐运动	138
简谐运动动力学	140
练习题	141
<b>7 波和声</b>	<b>147</b>
脉冲	147
波动	149
波的类型	150
驻波和共振	151
声	153
多普勒效应	155
练习题	157
<b>8 重力</b>	<b>161</b>
牛顿万有引力定律	161
引力能	163



练习题	166
<b>9 碰撞和线性动量</b>	<b>171</b>
内力和外力	171
碰撞力和动量变化	172
线性动量守恒定律	173
弹性和非弹性碰撞	174
质心	176
练习题	179
<b>10 转动运动</b>	<b>185</b>
平行力和力矩	185
扭矩	187
力和扭矩在更多静态平衡问题上的使用	188
惯性力矩	190
角运动	190
角动量	191
练习题	192
<b>11 静电学</b>	<b>199</b>
电荷的本质	199
电荷的检测和测量	200
库仑定律	201
电场	203
电势	205
电容	207
练习题	210
<b>12 电路</b>	<b>219</b>
电流和电	219
电阻	221
电功率和电能	223
串联和并联	224
组合电路	229
电路中的电容器	230
电能是势能	233
练习题	235
<b>13 磁学和电磁学</b>	<b>241</b>
磁场和磁场力	241
运动电荷产生的磁场力	243
通电导线产生的磁场	247
两导线间的磁场力	250

导线中的电磁感应动态电动势·····	251
磁通量和法拉第电磁感应定律·····	254
练习题·····	256
14 物理光学·····	263
电磁波·····	263
反射·····	265
折射·····	265
光折射的应用·····	268
光的干涉和衍射·····	269
练习题·····	273
15 几何光学·····	281
平面镜成像·····	281
曲面镜成像·····	282
透镜成像·····	286
练习题·····	290
16 流体·····	297
静态流体·····	297
帕斯卡原理·····	297
静压和深度·····	298
浮力与阿基米得原理·····	299
流体的运动·····	300
伯努利方程·····	301
练习题·····	305
17 热力学·····	311
温度及其测量·····	311
摩尔量·····	312
理想气体状态方程·····	313
分子运动理论·····	315
气体膨胀做功·····	316
热力学第一定律·····	317
热力学第二定律和热机·····	318
热传递·····	322
练习题·····	324
18 二十世纪物理学·····	331
光电效应·····	331
康普顿效应与光子动量·····	334
物质波·····	335
光谱线·····	336

狭义相对论	337
质能等价性	338
原子结构和卢瑟福模型	339
波尔模型	341
量子力学和电子云模型	342
核结构和稳定性	343
结合能	345
放射性衰变	346
裂变	348
聚变	348
练习题	351

## 模拟试题

AP物理1	363
模拟试题1	363
答案	380
答案解析	380
考试分析	394
模拟试题2	397
答案	413
答案解析	413
考试分析	426
AP物理2	429
模拟试题1	429
答案	443
答案解析	443
考试分析	454
模拟试题2	457
答案	469
答案解析	469
考试分析	477

## 附录

AP物理1信息表	481
AP物理2信息表	484
术语	487
索引	501

# CONTENTS

## **Barron's Essential 5**

AP Physics 1.....	xv
AP Physics 2.....	xvii

<b>Preface</b> .....	xix
----------------------	-----

<b>Introduction</b> .....	1
---------------------------	---

<b>Study Skills and Tips</b> .....	3
------------------------------------	---

## **DIAGNOSTIC TESTS**

<b>AP Physics 1</b> .....	17
---------------------------	----

Answer Key.....	24
Answers Explained.....	25

<b>AP Physics 2</b> .....	35
---------------------------	----

Answer Key.....	44
Answers Explained.....	45

## **REVIEW AND PRACTICE**

<b>1 Overview of AP Physics Concepts</b> .....	53
--	----

The Seven Big Ideas.....	53
Objects vs. Systems.....	53
Fundamental Particles.....	54

<b>2 Vectors</b> .....	55
------------------------	----

Coordinate Systems and Frames of Reference.....	55
Vectors.....	56
Addition of Vectors.....	57
Subtraction of Vectors.....	60
Addition Methods Using the Components of Vectors.....	61
Practice Exercises.....	63

<b>3 Kinematics</b> .....	69
---------------------------	----

Average and Instantaneous Motion.....	69
Acceleration.....	71
Accelerated Motion due to Gravity.....	74

**AP 2 only**

Graphical Analysis of Motion.....	76
Relative Motion.....	78
Horizontally Launched Projectiles.....	79
Projectiles Launched at an Angle .....	81
Uniform Circular Motion .....	83
Practice Exercises .....	85
<b>4 Forces and Newton's Laws of Motion .....</b>	<b>95</b>
Forces.....	95
Newton's Laws of Motion .....	97
Static Applications of Newton's Laws.....	99
Dynamic Applications of Newton's Laws .....	102
Central Forces.....	102
Friction .....	103
Practice Exercises .....	108
<b>5 Energy.....</b>	<b>119</b>
Work.....	119
Power.....	122
Kinetic Energy and the Work-Energy Theorem .....	122
Potential Energy and Conservative Forces.....	124
Conservation of Energy and Systems.....	124
Practice Exercises .....	128
<b>6 Oscillatory Motion .....</b>	<b>135</b>
Simple Harmonic Motion: A Mass on a Spring.....	135
Simple Harmonic Motion: A Simple Pendulum.....	138
The Dynamics of Simple Harmonic Motion.....	140
Practice Exercises .....	141
<b>7 Waves and Sound .....</b>	<b>147</b>
Pulses.....	147
Wave Motion .....	149
Types of Waves .....	150
Standing Waves and Resonance .....	151
Sound.....	153
The Doppler Effect .....	155
Practice Exercises .....	157
<b>8 Gravitation.....</b>	<b>161</b>
Newton's Law of Universal Gravitation .....	161
Gravitational Energy.....	163
Practice Exercises .....	166
<b>9 Impacts and Linear Momentum.....</b>	<b>171</b>
Internal and External Forces .....	171
Impact Forces and Momentum Changes.....	172

The Law of Conservation of Linear Momentum .....	173	
Elastic and Inelastic Collisions .....	174	
Center of Mass .....	176	<b>AP 2 only</b>
Practice Exercises .....	179	
<b>10 Rotational Motion .....</b>	<b>185</b>	
Parallel Forces and Moments .....	185	
Torque .....	187	
More Static Equilibrium Problems Using Forces and Torques.....	188	
Moment of Inertia.....	190	
Angular Kinematics.....	190	
Angular Momentum.....	191	
Practice Exercises .....	192	
<b>11 Electrostatics .....</b>	<b>199</b>	
The Nature of Electric Charges.....	199	
The Detection and Measurement of Electric Charges .....	200	<b>AP 2 only</b>
Coulomb's Law .....	201	
The Electric Field.....	203	
Electric Potential.....	205	<b>AP 2 only</b>
Capacitance .....	207	<b>AP 2 only</b>
Practice Exercises .....	210	
<b>12 Electric Circuits .....</b>	<b>219</b>	
Current and Electricity .....	219	
Electric Resistance.....	221	
Electric Power and Energy.....	223	
Series and Parallel Circuits.....	224	
Combination Circuits.....	229	
Capacitors in Circuits.....	230	<b>AP 2 only</b>
Electrical Energy Is Potential Energy .....	233	
Practice Exercises .....	235	
<b>13 Magnetism and Electromagnetism.....</b>	<b>241</b>	<b>AP 2 only</b>
Magnetic Fields and Forces.....	241	
Magnetic Force on a Moving Charge .....	243	
Magnetic Fields due to Currents in Wires.....	247	
Magnetic Force Between Two Wires .....	250	
Induced Motional EMF in a Wire .....	251	
Magnetic Flux and Faraday's Law of Induction.....	254	
Practice Exercises .....	256	
<b>14 Physical Optics.....</b>	<b>263</b>	<b>AP 2 only</b>
Electromagnetic Waves.....	263	
Reflection .....	265	
Refraction.....	265	
Applications of Light Refraction.....	268	

	Interference and Diffraction of Light.....	269
	Practice Exercises .....	273
<b>15</b>	<b>Geometrical Optics</b> .....	281
	Image Formation in Plane Mirrors.....	281
	Image Formation in Curved Mirrors.....	282
	Image Formation in Lenses.....	286
	Practice Exercises .....	290
<b>16</b>	<b>Fluids</b> .....	297
	Static Fluids .....	297
	Pascal's Principle.....	297
	Static Pressure and Depth.....	298
	Buoyancy and Archimedes' Principle.....	299
	Fluids in Motion.....	300
	Bernoulli's Equation.....	301
	Practice Exercises .....	305
<b>17</b>	<b>Thermodynamics</b> .....	311
	Temperature and Its Measurement .....	311
	Molar Quantities.....	312
	The Ideal Gas Law Equation of State.....	313
	Kinetic-Molecular Theory .....	315
	Work Done by Expanding Gases .....	316
	The First Law of Thermodynamics.....	317
	The Second Law of Thermodynamics and Heat Engines.....	318
	Heat Transfer.....	322
	Practice Exercises .....	324
<b>18</b>	<b>Twentieth-Century Physics</b> .....	331
	Photoelectric Effect.....	331
	Compton Effect and Photon Momentum.....	334
	Matter Waves .....	335
	Spectral Lines.....	336
	Special Relativity .....	337
	Mass-Energy Equivalence .....	338
	Atomic Structure and Rutherford's Model .....	339
	The Bohr Model.....	341
	Quantum Mechanics and the Electron Cloud Model .....	342
	Nuclear Structure and Stability .....	343
	Binding Energy .....	345
	Radioactive Decay .....	346
	Fission.....	348
	Fusion .....	348
	Practice Exercises .....	351

AP 2 only

AP 2 only

AP 2 only

AP 2 only

## PRACTICE TESTS

<b>AP Physics 1</b> .....	363
Practice Test 1 .....	363
Answer Key .....	380
Answers Explained .....	380
Test Analysis .....	394
Practice Test 2 .....	397
Answer Key .....	413
Answers Explained .....	413
Test Analysis .....	426
<b>AP Physics 2</b> .....	429
Practice Test 1 .....	429
Answer Key .....	443
Answers Explained .....	443
Test Analysis .....	454
Practice Test 2 .....	457
Answer Key .....	469
Answers Explained .....	469
Test Analysis .....	477

## Appendix

<b>Table of Information for AP Physics 1</b> .....	481
<b>Table of Information for AP Physics 2</b> .....	484
Glossary .....	487
Index .....	501



# Introduction 导论

## KEY CONCEPTS

- UNITS
- RELATIONSHIPS AND REVIEW OF MATHEMATICS
- TIPS FOR ANSWERING MULTIPLE-CHOICE QUESTIONS
- TIPS FOR SOLVING FREE-RESPONSE QUESTIONS
- EXPERIMENTAL DESIGN QUESTIONS
- GRAPHS, FITS, AND THE LINEARIZATION OF DATA
- UNCERTAINTY AND PERCENT ERROR
- STUDY SKILLS AND SCHEDULING YOUR REVIEW

## STRUCTURE AND SCOPE OF THE AP PHYSICS EXAMS

### AP物理考试结构和范围

The College Board has replaced its traditional AP Physics B exam. Although many changes have occurred, the most basic is that the exam is now being reissued as two exams. The AP Physics 1 exam corresponds to a first-year course, and the AP Physics 2 exam corresponds to a second-year course. Both exams are algebra based (as opposed to the calculus-based AP Physics C exams). Both will focus on conceptual underpinnings and basic scientific reasoning alongside the traditional problem-solving aspects of physics. In addition, both exams have questions that require experiential lab understanding. Both exams are based on the same “Seven Big Ideas” in physics. Although the exams do concentrate on different topics, some overlap occurs between the two exams, enabling this one book to cover all topics required for both exams.

AP Physics 1 focuses on mechanics (including rotational mechanics), the conservation laws (energy as well as both linear and angular momentum), introductory circuits, and mechanical waves (including sound). AP Physics 2 focuses on electrostatics, electromagnetism (including light as a wave), fluid mechanics, thermodynamics, optics, and modern physics. Both exams include multiple-choice questions as well as free-response questions.

## ORGANIZATION OF THIS BOOK 本书的组织结构

This introduction serves as general background information that the student will find useful for either exam. The next section contains two separate diagnostic exams (one for AP Physics 1 and the other for AP Physics 2) that will help students determine their weaknesses and target the specific chapters in this book that will be most beneficial to them.

With chapter 1, the physics content begins. Each subsequent chapter has practice problems at the end along with complete solutions. Generally speaking, the content for AP Physics 1 is in the earlier chapters while the content for AP Physics 2 is in the later chapters. A complete breakdown of chapter sections is shown in the table that follows. Each topic is identified as being for AP Physics 1 (1), AP Physics 2 (2), or both exams (B). In addition, each section of