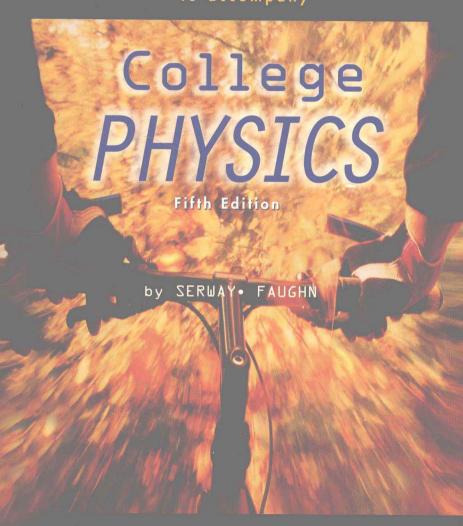
Pocket Guide



V. GORDON LIND

Pocket Guide to Accompany COLLEGE PHYSICS

by Serway & Faughn

A Capsule of the Textbook and a Notebook with Problem-Solving Hints

V. GORDON LIND

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Preface

When students study physics from a textbook, they usually go through it very carefully underlining or highlighting the material most likely needed for an upcoming examination. Some students are more skilled than others in selecting the appropriate material, but all students pick essentially (within 10 to 20%) the same material. As a teacher of physics students, it occurred to me that a small booklet could be prepared to be a skeleton of the text. The booklet could include the most important material from the textbook, along with generous margins that the student can make notes on when listening to a lecture or reading the text. Therefore, most of the note taking is already done, and the student can then further supplement and thus customize the pocket guide.

This pocket guide a miniaturization of the text and, therefore, is designed to closely follow the main text. Nevertheless, in reducing the size, I had to decide which information to include and which to exclude. In making these decisions, I hope that the message presented is still coherent, understandable, and relevant. It was necessary to write this book in my own words and style. Therefore, I accept full responsibility for errors in the manuscript and any lack of clarity.

Each chapter has a brief section on the concepts and a section on hints for solving the problems. Students need to solve large numbers of problems in order to master physics, and they need to do it on their own. However, sometimes a hint is needed to get things going, and it is in this spirit of helpfulness that the hint section is included.

As an author I appreciate the opportunity provided by Saunders College Publishing to write and provide this little book. It has been a lot of work but also fun to write. I appreciate the support and encouragement from John Vondeling, Publisher; Susan Dust Pashos, Senior Developmental Editor; and particularly Alexandra Buczek and Suzanne Hakanen, Ancillary Editors. I also appreciate Ray Serway and Jerry S. Faughn and their support.

I am greatly indebted to Michael Tammaro at the University of Rhode Island, the reviewer who carefully and critically read the manuscript and offered numerous suggestions for clarification and correction of confusing or misleading statements. I am also grateful to Dr. Robert Capener in the Computer Science Department at Weber State University who took the time and provided the help needed to recover from a hard disk crash on my computer just days before publication.

Finally, but not least, I appreciate the support and encouragement of my wife Linda and our children.

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Prologue

The Study of Physics

What is physics? It is a study of the laws and principles of all phenomena of nature. This includes studies of astronomy, chemistry, geology, and even biology (to a large extent), and much more. The principal branches of physics studied in an introductory course, such as this one, are:

- <u>Classical Mechanics</u> (The study of matter in motion and its causes, i.e., forces.)
- Relativity (The study of motion and natural laws near light velocity. It also works at low velocities.)
- Thermodynamics (Statistical behavior of motion.)
- <u>Electromagnetism including Optics</u> (Detailed effects of electricity and magnetism resulting from one of nature's fundamental force laws.)
- Quantum Mechanics (A study of motion and behavior of matter on the atomic and nuclear level. This also includes most of modern physics.)

We have learned to trust these theories. Discrepancies between established theories and experiments are unexpected. Physics and science in general are based on theories, laws, and principles that agree with experimental observations and these do. Experimental results in disagreement with established concepts are probably wrong. But if discordant results are repeatable and verified, then the concept, no matter how appealing and popular, must be ques-

tioned, corrected, and brought into agreement with experiment.

The power of mathematics and logical reasoning are needed to develop theories. In some cases they are so powerful as to give insights into nature and predict totally surprising outcomes of experimental observation with great assurance. Examples include the prediction of antimatter before its discovery and very recently the prediction of the existence, and even the mass of the top quark.

As students learn to use physical concepts, theories, laws and principles in the solutions of problems of daily life (and textbook problems) and see the agreement with observation, they gain a sense of excitement and power. As you proceed through the course, you too will marvel at your new abilities. Therein lies the "fun" of physics. It is exciting to understand how and why things work and particularly nature.

Finally, as an aid to success in physics (and anything else), remember that *persistence* and *determination* alone are omnipotent and "practice makes perfect".

The Student Use of the Pocket Guide

This pocket guide is intended to help you learn and master physics as presented in Serway's textbook, Principles of Physics. It is a condensed version of the book with the principles, laws, concepts, and equations retained. If you were to go through the text and personally identify the most important ideas by underlining and highlighting, and then put these in a separate book, you would, it is hoped, have essentially the same content as you now find in this booklet. However, the Pocket Guide is in no way intended to replace the text. The text is much more complete and the source of your study in learning the concepts. The text also contains problem examples, concept questions, enrichment material, photographs and illustrations, and sets of questions and problems at the end of each chapter as a resource to you to sharpen your understanding.

There are reasonable margins in this little book thus making space for some notes. Also, there are blank pages at the end of about half the chapters. Thus, your pocket guide can be your notebook for physics. It is small enough to be easily carried everywhere you go. You won't need to carry the big text with you and risk losing it or having it damaged. With a one for one mapping of chapters, sections and subsections between the pocket guide and the text, it should be easy to transfer notes and materials collected from one to the other. We have also wanted to make a one for one match of the equation numbers, but in several cases it

hasn't been possible. Differences in equation numbering will generally be no more than one or two digits and often there is an exact match.

By having the pocket guide with you, you can study physics at the bus stop, at the ball game, at the restaurant while waiting for your order, while waiting for a friend, or anywhere else when you have a few moments. It is designed for easy access and for quick review of formulas, concepts, principles and ideas. Mark it up! Personalize it! The more you do so, the more helpful and valuable it will become to you.

The "Concept Statements and Questions" section is added to help you gauge your understanding of the subject material in each chapter. Learning and understanding concepts is one of the more difficult aspects of mastering physics. Use this section as it best serves your needs. It may be most useful in studying for a quiz or examination.

Also there is a section on "Hints for Solving the Problems". There are many hints provided. Some are similar to what is found in the text itself and there are also several others. Very few problems have hints directed solely towards their solution. It is realized that this section could be greatly enlarged with hints for every problem, but that would make the book too large. Besides, there is a separate study guide with hundreds of worked out problems available for this course and the details you find there will take care of your need for seeing problems worked out in detail. Nevertheless, the hints given here may be just what you need to solve some of the problems and please notice, the hints are directed towards the even numbered problems as well as the odd ones. We add it here as an overall help.

As a guide to learning and mastering physics we suggest the following.

- 1. Read through the entire pocket guide before the class begins or as early as possible. It is short. This will give you a general background of physics and what you will be studying for the year ahead. This overview will help in preparing you for your learning experience. (Reading the entire textbook would also be good if you have the time.)
- 2. Read the individual chapters again prior to lecture. If time permits, read the textbook chapter, otherwise, at least read the pocket guide chapter. That way you will be prepared for the lecture and know something about it before you hear the lecture.
- 3. Attend the lecture with your pocket guide in hand. Listen intently to the lecture, watch the demonstrations watch any audio-visual material presented, and listen carefully to all explanations. Do not take extensive notes because you will miss much of what is going on if you do. But you can jot a few notes down into the margins of your pocket guide of things that are definitely helpful. Label them L: for lecture. The pocket guide should have most of the information already, so what you add is just a supplement.
- 4. Ask relevant questions of the instructor about unclear concepts and add the answers to your notes.
- 5. Study the textbook chapter intently and completely and transfer any important items you wish to the pocket guide under the same section heading and label it T: for text and give the page number. That way you

can go back to the text to the exact spot for review if needed.

- 6. Work the assigned problems and any others you have time for. The more problems you work, the better you will learn and master physics. Get help on the problems you can't work from a fellow student, your recitation teacher, study guide or instructor. Make sure you understand not only how the problems are worked but the details of why the method works and even other ways of doing the same problems.
- 7. As you prepare for an examination, review your problem solutions and all the exercises from the text. Review all the material you will be examined on by going through your pocket guide and the notes you have made in its margins. Study the text as needed, especially the material you have made notes about.
- 8. As you take the exam do so with confidence knowing that you have prepared well and you will surely do well.
- 9. From time to time make a quick review of all you have learned about physics by reading through the pocket guide and text. The learning acquired in which you invested so much time, will be retained, thereby, and enable you to use it in your future classes and in life's experiences. Otherwise, most of it will soon be forgotten.

A Brief Word about Notation

Scalar variables are italicized. Vector variables, except for those vectors represented by Greek letters, are bold-faced characters and not italicized. The font for Greek letters is the same for vectors as for scalars. The word processor used to write this guide book didn't have all of the characters exactly as in the text book. Characters similar in appearance were substituted. Also in one or two instances the notation was changed slightly for simplicity or clarification from the writer's view point. It is hoped that this goal was achieved and did not add any confusion.

		Concept Statements and Questions 22	
		Hints for Solving the Problem	ns 23
1	1		
Introduction 1		4	27
Standards of Length, Mass and Time 1		The Laws of Motion 27	
The Building Blocks of Matter 2		The Concept of Force 27	
Dimensional Analysis 2		Newton's First Law 29	
Significant Figures 3		Newton's Second Law 30	
Conversion of Units 3		Newton's Third Law 31	
Order of Magnitude Calculations 4		Some Applications of Newton's Laws 32	
Mathematical Notation 4		Force of Friction 33	
Coordinate Systems and Frames of Reference 5		Concept Statements and Questions 35	
Trigonometry 5		Hints for Solving the Problems 35	
Problem Solving Strategy 6			
Concept Questions and Sta	tements 7	5	39
Hints for Solving the Problems 7		Work and Energy 39	
		Work 40	
2	9	Kinetic Energy and the Work-	-Kinetic Energy Theorem 40
Motion in One Dimension 9		Potential Energy 41	
Displacement 9		Conservative and Nonconservative Forces 42	
Average Velocity 10		Conservation of Mechanical Energy 43	
Instantaneous Velocity 10		Nonconservative Forces and t	he Work-Kinetic Energy
Acceleration 11			Theorem 44
Motion Diagrams 11		Conservation of Energy in General 45	
One-Dimensional Motion with Constant Acceleration 12		Power 45	
Freely Falling Bodies 13		Concept Statements and Questions 46	
Concept Statements and Questions 13		Hints for Solving the Problems 47	
Hints for Solving Problems	14		
		6	49
3	17	Momentum and Collision	ns 49
Vectors and Two-Dimensional Motion 17		Momentum and Impulse 49	
Vectors and Scalars Revisted 17		Conservation of Momentum 50	
Some Properties of Vectors 18		Collisions 51	
Components of a Vector 19		Glancing Collisions 52	
Velocity and Acceleration in Two Dimensions 19		Concept Statements and Questions 53	
Projectile Motion 21		Hints for Solving the Problems 54	

Relative Velocity 22

57 Other Applications of Bernoulli's Equation 81 Circular motion and the Law of Gravity 57 Surface Tension, Capillary Actions, and Viscosity 82 Transport Phenomena 84 Angular Speed and Angular Acceleration 57 Concept Statements and Ouestions 84 Rotational Motion under Constant Angular Acceleration Hints for Solving the Problems 86 Relations Between Angular and Linear Quantities 59 Centripetal Acceleration 59 89 10 Centripetal Forces Causing Centripetal Accelerations 60 Thermal Physics 89 Describing Motion of a Rotating System 60 Temperature and the Zeroth Law of Thermodynamics 89 Newton's Universal Law of Gravitation 61 Thermometers and Temperature Scales 90 Gravitational Potential Energy Revisited 61 Thermal Expansion of Solids and Liquids 91 Kepler's Laws 62 Macroscopic Description of an Ideal Gas 92 Concepts Statements and Questions 64 Avogadro's Number and the Ideal Gas Law 93 Hints for Solving the Problems 64 The Kinetic Theory of Gases 93 Concept Statements and Ouestions 95 8 67 Hints for Solving the Problems 96 Rotational Equilibrium and Dynamics 67 11 99 Torque and the Second Condition for Equilibrium 68 Heat 99 The Center of Gravity 69 The Mechanical Equivalent of Heat 99 Examples of Objects in Equilibrium 69 Specific Heat 100 Relationship Between Torque and Angular Acceleration Conservation of Energy: Calorimetry 101 Latent Heat and Phase Changes 101 Rotational Kinetic Energy 70 Heat Transfer by Conduction 102 Angular Momentum 71 Convection 103 Concept Statements and Questions 71 Radiation 104 Hints for Solving the Problems 72 Hindering Heat Transfer 104 Metabolism and Losing Weight 105 9 75 Application: Global Warming and Greenhouse Gases 105 Solids and Fluids 75 Concept Statements and Questions 106 States of Matter 75 Hints for Solving the Problems 107 The Deformation of Solids 76 Density and Pressure 77 12 109 Variation of Pressure with Depth 78 The Laws of Thermodynamics 109 Pressure Measurements 78 Heat and Internal Energy 109 Buoyant Forces and Archimedes' Principle 79 Work and Heat 110

The First Law of Thermodynamics 111

Fluids in Motion 80

Entropy 113 **Ouality of Sound 136** Entropy and Disorder 114 The Ear 136 Concept Statements and Questions 115 Concept Statements and Questions 137 Hints for Solving the Problems 116 Hints for Solving the Problems 138 13 119 15 141 Vibrations and Wave Motion 119 Electric Forces and Electric Fields 141 Hooke's Law 119 Properties of Electric Charges 141 Elastic Potential Energy 120 Insulators and Conductors 142 Velocity as a Function of Position 121 Coulomb's Law 143 Comparing Simple Harmonic Motion with Circular Electric Fields 143 Motion 121 Electric Field Lines 144 Position, Velocity, and Acceleration as a Function of Time Conductors in Electrostatic Equilibrium 145 122 The Millikan Oil-Drop Experiment 145 Motion of a Pendulum 122 The Van de Graff Generator 146 Damped Oscillations 123 The Oscilloscope 146 Wave Motion 123 Electric Flux and Gauss's Law 146 Types of Waves 124 Concept Statements and Questions 148 Frequency, Amplitude and Wavelength 124 Hints for Solving the Problems 149 The Speed of Waves on Strings 125 Superposition and Interference of waves 125 Reflection of Waves 125 16 151 Concept Statements and Questions 126 Electrical Energy and Capacitance 151 Hints for Solving the Problems 127 Potential Difference and Electric Potential 151 Electric Potential and Electric Potential Energy Due to Point Charges 153 14 129 Potentials and Charged Conductors 153 Sound 129 Equipotential Surfaces 154 Producing a Sound Wave 129 Applications 155 Characteristics of Sound Waves 129 The Definition of Capacitance 155 The Speed of Sound 130 The Parallel-Plate Capacitor 156 Energy and Intensity of Sound Waves 131 Combinations of Capacitors 156 Spherical and Plane Waves 132 Energy Stored in a Charged Capacitor 157 The Doppler Effect 132 Capacitors with Dielectrics 158 Interference in Sound Waves 133

Standing Waves 134

Reats 136

Forced Vibrations and Resonance 135

Standing Waves in Air Columns 135

Heat Engines and The Second Law of Thermodynamics

Reversible and Irreversible Processes 112

The Carnot Engine 112

Application: DNA and Forensic Science 159 Motion of a Charged Particle in a Magnetic Field 184 Concept Statements and Questions 159 Magnetic Field of a Long, Straight Wire and Ampere's Law 184 Hints for Solving the Problems 160 The Magnetic Force Between Two Parallel Conductors 185 17 163 Magnetic Field of a Current Loop 186 Current and Resistance 163 The Magnetic Field of a Solenoid 186 Electric Current 163 Magnetic Domains 187 Current and Drift Speed 164 Concept Statements and Questions 187 Resistance and Ohm's Law 164 Hints for Solving the Problems 188 Resistivity 165 Temperature Variation of Resistance 165 20 191 Superconductors 165 Induced Voltages and Inductance 191 Electrical Energy and Power 166 Induced emf and Magnetic Flux 191 Voltage Measurements in Medicine 167 Faraday's Law of Induction 192 Concept Statements and Questions 167 Motional emf 193 Hints for Solving the Problems 168 Lenz's Law Revisited 194 Generators 194 18 171 Eddy Currents 195 Direct Current Circuits 171 Self-Inductance 196 Sources of emf 171 RL Circuits 196 Resistors in Series 172 Energy Stored in a Magnetic Field 197 Resistors in Parallel 172 Concept Statements and Questions 197 Kirchhoff's Rules and Simple DC Circuits 173 Hints for Solving the Problems 198 RC Circuits 173 Household Circuits 174 21 201 Electrical Safety 175 Alternating Current Circuits and Electromagnet-Concept Statements and Questions 175 ic Waves 201 Hints for Solving the Problems 176 Resistors in an ac Circuit 201 Capacitors in an ac Circuit 202 19 179 Inductors in an ac Circuit 203 Magnetism 179 The RLC Series Circuit 203 Magnets 179 Power in an ac Circuit 204 The Magnetic Field of the Earth 180 Resonance in a Series RLC Circuit 204 Magnetic Fields 181 The Transformer 205 Magnetic Force on a Current-Carrying Conductor 182 Maxwell's Predictions 205 Torque on a Current Loop 182 Hertz's Discoveries 206

The Galvanometer and Its Applications 183

The Production of Electromagnetic Waves by an Antenna 207

Properties of Electromagnetic Waves. 207
The Spectrum of Electromagnetic Waves 208
Concept Statements and Questions 209
Hints for Solving the Problems 210

22 213 Reflection and Refraction of Light 213

The Nature of Light 213
Measurements of the Speed of Light 214
The Ray Approximation in Geometric Optics 215

Reflection and Refraction 215
The Law of Refraction 216

Dispersion and Prisms 216

The Rainbow 217

Huygens's Principle 217 Total Internal Reflection 218

Concept Statements and Questions 219 Hints for Solving the Problems 220

23 223

Mirrors and Lenses 223

Flat Mirrors 223

Images Formed by Spherical Mirrors 224

Convex Mirrors and Sign Conventions 225 Images Formed by Refraction 225

Atmospheric Refraction 226

Thin Lenses 226

Lens Aberrations 228

Concept Statements and Questions 228

Hints for Solving the Problems 229

24 231 Wave Optics 231

Conditions for Interference 231

Young's Double-Slit Experiment 232

Change of Phase Due to Reflection 233

Interference in Thin Films 233

Diffraction 234

Single-Slit Diffraction 234

Polarization of Light Waves 235

Concept Statements and Questions 237

Hints for Solving the Problems 238

25 241

Optical Instruments 241

The Camera 241

The Eye 242

The Simple Magnifier 243

The Compound Microscope 244

The Telescope 244

Resolution of Single-Slit and Circular Apertures 245

The Michelson Interferometer 245

The Diffraction Grating 246

Concept Statements and Questions 247

Hints for Solving the Problems 248

26 251

Relativity 251

Introduction 251

The Principle of Relativity 251

The Speed of Light 252

The Michelson-Morley Experiment 252

Einstein's Principle of Relativity 253

Consequences of Special Relativity 253

Relativistic Momentum 255

Relativistic Addition of Velocities 255

Relativistic Energy 256

General Relativity 257

Concept Statements and Questions 258

Hints for Solving the Problems 259