

Contents

[Key: GL (Guided Learning), TI (Traditional Instruction), and CI (Computer Instruction), GL is associated only with TI experiments. See Preface.]

Preface	xi
Introduction	xv
Why We Make Experimental Measurements	xv
General Laboratory Procedures	xv

Experiments in the bound volume

1. The Scientific Method and Thought	1
2. Experimental Uncertainty (Error) and Data Analysis	11
3. Measurement Instruments (Mass, Volume, and Density)	31
4. (GL) Simple Pendulum Parameters (Angle, Mass, Length, and Damping)	45
5. (TI-GL/CI) Uniformly Accelerated Motion: Measurement of g	57
6. The Addition and Resolution of Vectors: The Force Table	75
7. (TI-GL/CI) Newton's Second Law: The Atwood Machine	85
8. (TI/CI) Conservation of Linear Momentum	105
9. (GL) Projectile Motion: The Ballistic Pendulum	129
10. Centripetal Force	143
11. (TI/CI) Friction	153
12. (GL) Work and Energy	173
13. Potential Energy of a Spring	187
14. (GL) Torques, Equilibrium, and Center of Gravity	195
15. (GL) Simple Machines: Mechanical Advantage	209
16. (TI/CI) Simple Harmonic Motion	225
17. Standing Waves in a String	245
18. Temperature and Thermometer Calibration	255
19. The Thermal Coefficient of Linear Expansion	261
20. Specific Heats of Metals	271

21. Archimedes' Principle: Buoyancy and Density	281
22. Fields and Equipotentials	293
23. (TI/CI) Ohm's Law	303
24. The Measurement of Resistance: Ammeter-Voltmeter Methods and Wheatstone Bridge Method	321
25. The Temperature Dependence of Resistance	335
26. (TI/CI) Resistances in Series and Parallel	347
27. Joule Heat	371
28. The RC Time Constant (Manual Timing)	379
29. (TI/CI) The RC Time Constant (Electronic Timing)	387
30. Reflection and Refraction	405
31. Spherical Mirrors and Lenses	415
32. (TI) Polarized Light (CI) Malus's Law	431
33. The Prism Spectrometer: Dispersion and the Index of Refraction	451
34. Line Spectra and the Rydberg Constant	459
35. (TI) The Transmission Diffraction Grating: Measuring the Wavelengths of Light (CI) Single-Slit and Double-Slit Diffraction	469
36. Detection of Nuclear Radiation: The Geiger Counter	493
37. Radioactive Half-Life	503
38. The Absorption of Nuclear Radiation	511
Appendix A Material Properties	523
Appendix B Mathematical and Physical Constants	529
Appendix C Absolute Deviation and Mean Absolute Deviation	532
Appendix D Standard Deviation and Method of Least Squares	533
Appendix E Graphing Exponential Functions	535

Experiments available in customized orders

39. (TI/CI) Rotational Motion and Moment of Inertia
40. Conservation of Angular Momentum and Energy: The Ballistic Pendulum
41. Elasticity: Young's Modulus
42. Air Column Resonance: The Speed of Sound in Air
43. (TI) Latent Heats: Heats of Fusion and Vaporization of Water (CI) Latent Heat of Fusion Water

44. Newton's Law of Cooling: The Time Constant of a Thermometer
45. The Potentiometer: emf and Terminal Voltage
46. The Voltmeter and Ammeter
47. Resistivity
48. Multiloop Circuits: Kirchhoff's Rules
49. The Earth's Magnetic Field
50. Introduction to the Oscilloscope
51. (TI/CI) Phase Measurements and Resonance in AC Circuits
52. (TI/CI) Electromagnetic Induction
53. The Mass of an Electron: e/m Measurement

The eighth edition of *Physics Laboratory Experiments* has 38 experiments, with 15 additional customized experiments. All experiments are available for purchase through TextChoice.com. (See Experiments Available for Customized Publishing.) This provides an ample number of experiments to cover from a two-semester or three-quarter physics course. Those features that proved effective in previous editions have been retained, along with Guided Learning (GL). Basically, GL is an effort to supplement the "cookbook" style for better learning and understanding; an Experimental Planning section gives a brief introduction and guides the students through the basics of an experiment by a series of related questions that they answer.

The GL Experimental Planning is limited to selected Traditional Instruction (TI) experiments, about which students should have some knowledge. These are listed in the table of contents.

Pre-Lab Demos

An added feature to the eighth edition of *Physics Laboratory Experiments* is a set of pre-lab demonstrations. The purpose of these demos is to "break the ice," so to speak. Students often come to the laboratory lacking enthusiasm. If something attention-getting (a demo) is presented initially that is related to the experiment or associated class material, interest is aroused. This being done, the instructor can lead into the current lab experiment. Abbreviated demo descriptions are given at the beginning of the experiments.

A complete list of demonstrations (with descriptions and explanations) is available online through the Instructor's Resource Manual.

Traditional Instruction (TI) and Customized Instruction (CI)

The use of computerized instructional equipment has become increasingly popular in introductory physics laboratories. To accommodate this, 10 experiments have both TI and CI editions, the latter of which describes an experiment using computerized equipment.* The TI and CI components generally treat the same principles but from different perspectives. These experiments give the instructor the option of doing the TI experiment, the CI experiment, or both.

It is suggested that in some instances students do the hands-on TI experiment first, so as to gain a basic knowledge of what is being measured. It is here that the physical parameters of the experiment are clearly associated with principles and results. Once students have this type acquaintance with experimental concepts, they can better perform the CI experiment (or view it as a demonstration if limited CI equipment is available).

The student can then better understand the computer procedure and analysis of electronic recorded data. This is particularly important in graphical analysis, where graphs are immediately plotted on monitor screens without a firm understanding of the parameters involved.

Experiments Available for Customized Publishing

These provide a handy, customizable option—a way for instructors to build their own lab manual that fits the need of their specific courses. All 33 experiments available in the printed manual, and an additional 15 experiments that include four TI-CI experiments, are available through TextChoice.

*Four more TI/CI experiments are available for the customized edition in the Table of Contents.