

**A STUDENT'S MANUAL OF
A LABORATORY COURSE
IN PHYSICAL
MEASUREMENTS**

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A Student's Manual of a Laboratory Course in Physical Measurements by Wallace Clement Sabine

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WALLACE CLEMENT SABINE

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PHYSICAL MEASUREMENTS.

BY

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PREFACE.

THIS manual was primarily written for use in the course in Harvard College known as "Physics C," and the experiments here detailed are based upon those performed in that course. The same course is given in the Summer School of Harvard University, beginning usually the first week in July and continuing six weeks, attended mainly by teachers. As given in college it requires 180 hours spent in the laboratory, and the student is held accountable for 90 hours of outside study. A knowledge of algebra and plane geometry, and a slight acquaintance with the notation of trigonometry is necessary. It should properly be preceded also by a more elementary course in physics, either by laboratory or text-book, preferably the former. For this purpose is recommended the quantitative course outlined in *A Text-Book of Physics*, Hall & Bergen, Holt & Co., New York. This course has for some time been in use most successfully as the laboratory alternative of the elementary physics required for admission to Harvard College. The course outlined in the following pages is designed to immediately follow this in college and to fit for the more advanced courses. It corresponds also to what is known as the advanced admission requirements in physics.

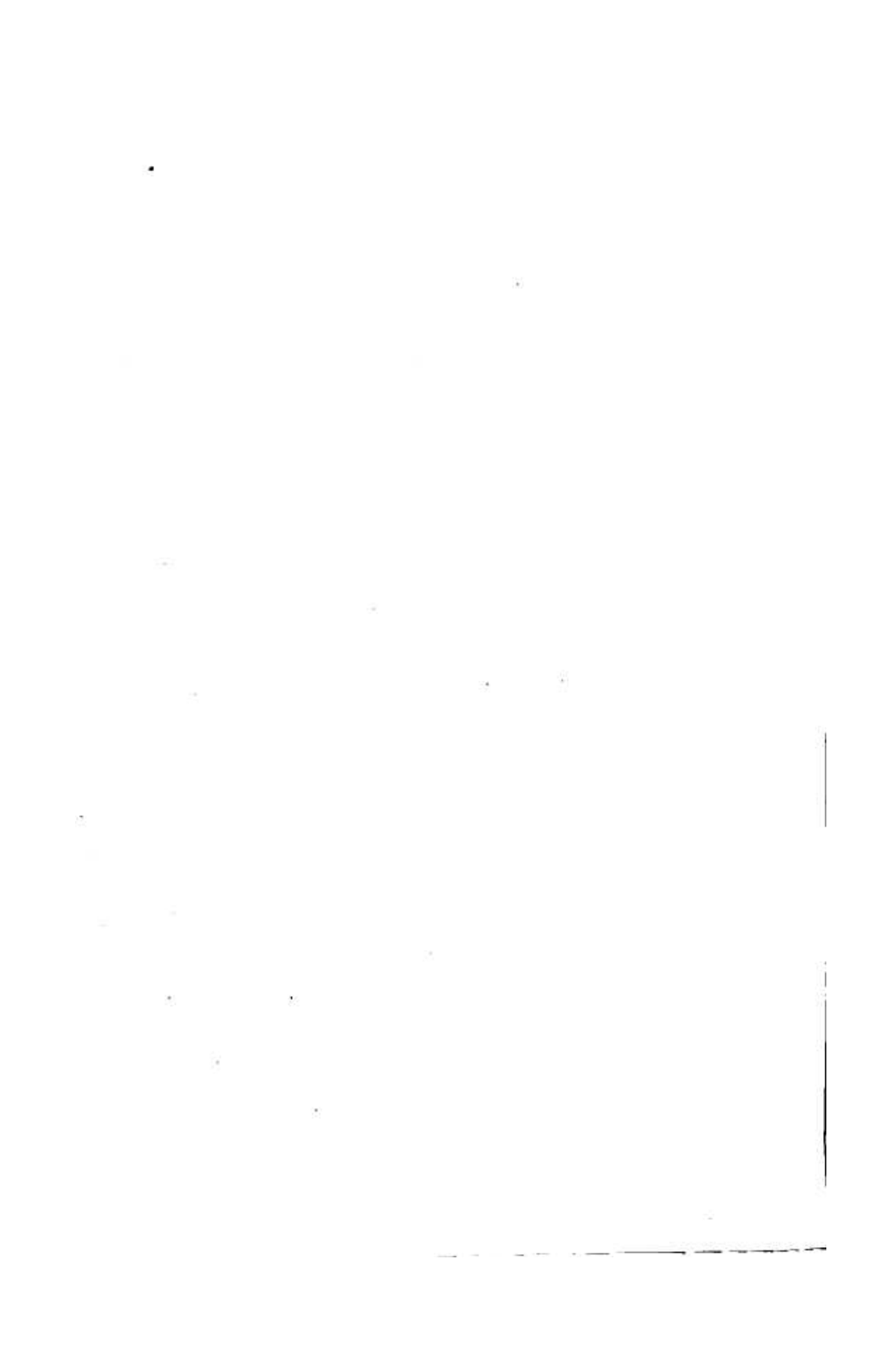
This manual, intended for students' use, has been given the form of an abstract of the daily lectures preceding the laboratory work and describing the experiments to be performed. It is intentionally condensed. A more extended treatment would render the book unwieldy and inconvenient for ready reference, and would perhaps allow the laboratory work to be a thoughtless following of too complete directions.

Many colleges have apparently been deterred from the more liberal introduction of the laboratory method of teaching physics by the great expense involved in fitting a laboratory for classes of any considerable size. The high price of apparatus to be found on the market allows even a fairly well endowed institution to purchase at most but a few instruments of each kind. But this, while in a certain way economical in the initial expense of apparatus, is very extravagant of teaching force, making an instructor wisely hesitate before assuming the burden of extending the course to his larger classes. For, with but few duplicate pieces of apparatus, either the laboratory sections must be small and the hours of work numerous, or one student must be engaged on one experiment while another is at work on some other, involving thus a separate detailed explanation to each. The departure from a systematic order of experiments, which this rotation method necessitates, is fatal to any progressive development of ideas. Moreover, apparatus designed originally for research or advanced work is often too delicate to allow that handling and inspection which is in itself most instructive. The complexity which adapts it to its original purpose unfits it for use as a classroom instrument, tending rather to confuse and perplex the student. In starting a laboratory course much routine detail work is involved in the devising of small pieces which it has been impossible to find on the market in the exact form required. Much of this must be home made, and the labor of superintendence is great. To remove as far as possible these difficulties a set of instruments has been devised especially adapted to the requirements of this course. The designs have been placed in the hands of instrument makers in Boston—Gillis & Gleeson, 106 Sudbury St.—with the restriction merely that the apparatus, when put upon the market, shall be sold at a price but little more than sufficient to pay for its proper manufacture and storage. The Physical Department of the University, being in no wise pecuniarily interested in

PREFACE.

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the manufacture of the apparatus, is not responsible for its mechanical perfection. If, however, this is at any time at fault, information to that effect will be considered an especial favor. No monopoly has been given for the manufacture of this apparatus, only the opportunity for that monopoly which an instrument maker can create for himself by good workmanship and reasonable charges.



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