PHYSICAL LABORATORY EXPERIMENTS: PART III.-HEAT

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PART III.—HEAT

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PREFACE

The following notes cover the experiments in Heat which are required of students taking the General Laboratory Course in Physics. The laboratory work is performed subsequent to or in some cases concurrently with the lecture course on Heat. Little or no attention is, therefore, devoted in these notes to theory, deduction of formulæ, etc., a knowledge of which is presupposed. On the other hand a detailed discussion is given of experimental methods, manipulation, sources of error and attainable precision,—these matters being regarded of paramount importance in all work performed in the physical laboratory at the Institute.

The cuts have been made from drawings of the actual apparatus used in the laboratory, and the description of the apparatus and procedure is given in such detail that the student is expected by studying his notes carefully before the exercise to be able to begin work at once on entering the laboratory without further reference to them. As most of the experiments described require about two hours—the usual laboratory period—for their completion, preparation for the work prior to the exercise is essential.

Many of the questions and problems at the end of each experiment require a knowledge of Precision of Measurements for their solution. These may be omitted by those students who have not had a course in that subject.

H. M. GOODWIN.

FEBRUARY, 1904.

THERMOMETRY

GENERAL DISCUSSION

These notes should be carefully studied before performing the experiments on Mercurial or Air Thermometry.

General Methods.—Thermometry is the art and science of temperature measurement. Any property of a substance which varies in a well known manner with its temperature may be made the basis of a system of thermometric measurement, and we find extensively used at the present time methods based on the following changes produced in bodies when heated or cooled:

a. Change of volume:—gas, mercury, alcohol thermometers.
b. Change of electrical resistance:—platinum resistance thermometers.
c. Change of thermo-electric force:—thermo-electric pyrometers.
d. Change of viscosity:—effusion or transpiration pyrometers.

In addition to these methods should also be mentioned specific heat pyrometers and optical pyrometers. The indications of the latter are based on the intensity or quality of light emitted by bodies at high temperatures. The term pyrometry is usually employed when referring to methods applicable to temperatures above 300° C.

The particular property or method which is best adapted to any given case depends of course upon the problem in hand as well as upon the actual temperature to be measured. Modern engineering as well as pure science demands methods covering a range of temperature from that of solid hydrogen—257.2° C. (Dewar, 1901), only 15° above the absolute zero, to that of the electric furnace, over 2000° C.

Of the several instruments mentioned above, gas thermometers are applicable over the widest range of temperatures.