

# **ELEMENTARY LESSONS IN HEAT**

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Elementary lessons in heat by S. E. Tillman

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**S. E. TILLMAN**

**ELEMENTARY  
LESSONS IN HEAT**



# ELEMENTARY LESSONS

IN

# HEAT.

BY

S. E. TILLMAN,

PROFESSOR OF CHEMISTRY, UNITED STATES MILITARY ACADEMY.

*FOURTH EDITION.*

REVISED AND ENLARGED.

FIRST THOUSAND

UNIV. OF  
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## PREFACE TO THIRD EDITION.

THE preface to the first edition of this book read as follows:

"These lessons have been prepared to meet the necessities of a very short course of study at the Military Academy in this branch of physics, a course so short that it can command for study and recitation only about seventy hours from the cadets.

"In selecting the material, I have been guided by the consideration of what is applicable to the subsequent courses of study at the Academy and also of what is essential and most useful for the student to know. In the arrangement I have kept in view facility of acquirement and thorough understanding, and, accordingly, the logical connection of the facts and principles set forth.

"In the exposition of the subjects treated, I have aimed at clearness and conciseness, and have omitted detailed descriptions of investigations and of apparatus as entirely as is consistent with the foregoing objects. Most of the experimental illustrations described or referred to are such as can be performed in the lecture-room."

The preface to the second edition contained this statement:

"In the use of the book experience has shown that many of the subjects touched upon are pregnant with suggestions to the pupils, and there is a great temptation to treat them more fully; but the object for which the lessons were prepared and the time that can be devoted to them, as stated in the preface to the first edition, are barriers to a more extended treatment, or to a different apportionment of space to the subjects treated."

The same necessities, conditions and objects as set forth in the above extracts have been the governing factors in this revision for the third edition, and they have prescribed the same limitations and general treatment as in the previous editions.

A number of changes, for the sake of simplicity or greater clearness, have been made both in the figures and in the text of the second edition.

The chapters relating to meteorology have been, in large part, rewritten, and the author is entirely indebted to the published papers of Prof. F. H. Bigelow, U. S. Weather Bureau, for new and interesting matter in this science. The publications of Prof. Bigelow have shown the necessity for a modification of Ferrel's view of the general circulation of the atmosphere, and they contain a new theory of cyclones, more satisfactory in conception and in much more perfect accord with observations than the generally accepted condensation theory. This new explanation of the cyclone is here adopted instead of that given in the second edition.

There are appended to this edition a few tables, valuable for use or reference.

S. E. TILLMAN.

WEST POINT, May 15, 1901.

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## PREFACE TO FOURTH EDITION.

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The conditions which produced the previous editions of this book and which have limited its scope and governed the treatment of the subject are briefly given in the preface to the third edition which preface is retained herein.

The conditions referred to are still such that no material changes in the book have been made, except that a short general description of steam turbine engines has been introduced.

S. E. T.

WEST POINT, N. Y., July 1, 1907.



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