CLARENDON PRESS SERIES. A TREATISE ON THE KINETIC THEORY OF GASES

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649525072

Clarendon Press Series. A Treatise on the Kinetic Theory of Gases by Henry William Watson

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

HENRY WILLIAM WATSON

CLARENDON PRESS SERIES. A TREATISE ON THE KINETIC THEORY OF GASES

Trieste

Clarendon Press Series

KINETIC THEORY OF GASES

WATSON

London
HENRY FROWDE
Oxford University Press Warehouse
Amen Corner, E.C.

New York
MACMILLAN & CO., 66 FIFTH AVENUE

Clarendon Press Series

A TREATISE

ON THE

KINETIC THEORY OF GASES

BY

HENRY WILLIAM WATSON, D.Sc., F.R.S.

FORMERLY FELLOW OF TRINITY COLLEGE, CAMBRIDGE

SECOND EDITION

Oxford

AT THE CLARENDON PRESS

1893

~~V. 14688~~
Phys 1900.5.2
HARVARD COLLEGE
DEC 2 1903
LIBRARY
Bowditch fund

Oxford
PRINTED AT THE CLARENDON PRESS
BY HORACE HART, PRINTER TO THE UNIVERSITY

PREFACE TO FIRST EDITION

THE idea of a Kinetic Theory of Gases originated with J. Bernouilli about the middle of the last century, but the first establishment of the theory on a scientific basis is due to Professor Clausius.

During the last few years the theory has been greatly developed by many physicists, especially by Professor Clerk Maxwell in England and Professor Clausius and Dr. Ludwig Boltzmann on the Continent; and although still beset by formidable difficulties, it has succeeded in explaining most of the established laws of gases in so remarkable a manner as to render it well worthy of the attentive consideration of scientific men.

My object in the following short treatise is to make the existing state of the theory more widely known by presenting some of the scattered memoirs of the writers I have mentioned in a systematic and continuous form, in the hope that mathematicians may be induced to turn their attention to the theory, and thus assist in removing, if possible, the obstacles which yet remain in the way of its complete establishment.

For the most part I have followed the method of treatment adopted by Dr. Ludwig Boltzmann in some very interesting memoirs contributed by him to the

Transactions of the Imperial Academy of Vienna,* but in some cases I have varied this treatment for the sake of greater conciseness or greater generality.

Thus, in place of Dr. L. Boltzmann's conception of a molecule as a collection of mutually attracting particles, I have substituted the more general conception of a material system possessing a given number of degrees of freedom, that is to say, a given number of generalised coordinates.

Again, in the deduction of the second law of Thermodynamics from the results of the Kinetic Theory, I felt some difficulty in following Dr. Boltzmann's reasoning, and I originally proposed to substitute for it a demonstration of my own, free from what appeared to me to be the obscurities of Dr. Boltzmann's reasoning, but applicable only to the case in which there were no intermolecular actions. My friend Mr. S. H. Burbury, formerly Fellow of St. John's College, Cambridge, to whom I communicated my difficulties, has invented an unexceptionable proof applicable to all cases, which he published last January in the London, Edinburgh, and Dublin Philosophical Magazine, and with his permission I have adopted this proof in the following treatise.

To Professor Clerk Maxwell I am indebted for much kind assistance, and especially for access to some of his manuscript notes on this subject, from which I have taken many valuable suggestions.

H. W. WATSON.

BERKSWELL RECTORY, COVENTRY:
Sept. 17, 1876.

* Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften Wien, Band 63, 1871, und Band 66, 1872.

PREFACE TO SECOND EDITION

MUCH interest has been manifested by physicists during the last thirty years in the Kinetic Theory of Gases.

This interest has been greatly stimulated by the researches of Maxwell in England and Boltzmann in Germany; but along with a growing conviction of the truth of *a* Kinetic Theory in its general aspect, the particular conclusions arrived at by these investigators concerning the laws of permanent distribution have been received with great distrust; they have been subjected to hostile criticism from mathematicians of such eminence that the mere weight of their authority must almost be accepted as conclusive, were there not room for the contention that these criticisms are not really directed against the laws themselves, as stated and applied in the Kinetic Theory, but against certain aspects of those laws with which the theory is not concerned.

The object of the original edition of this book was, as stated in the preface thereto, to set forth in a more systematic, and in some cases a more simple form, the