

INTRODUCTION TO CHEMICAL SCIENCE

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Introduction to Chemical Science by R. P. Williams

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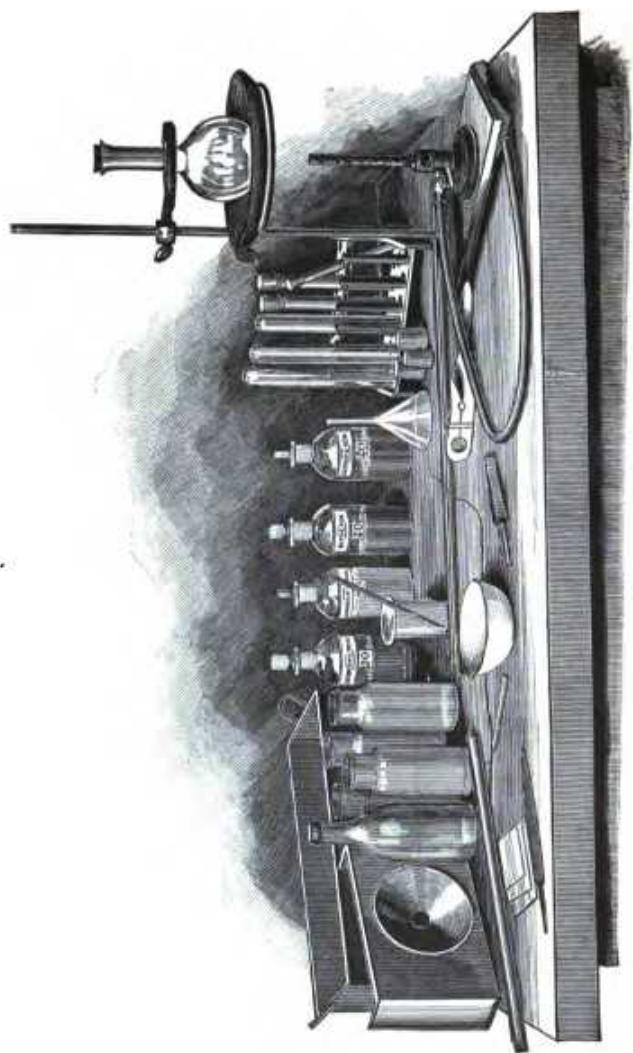
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APPARATUS FOR EACH PUPIL. (See Appendix.)

INTRODUCTION

TO

CHEMICAL SCIENCE.

BY

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PREFACE.

THE object held constantly in view in writing this book has been to prepare a suitable text-book in Chemistry for the average High School, — one that shall be simple, practical, experimental, and inductive, rather than a cyclopædia of chemical information.

For the accomplishment of this purpose the author has endeavored to omit superfluous matter, and give only the most useful and interesting experiments, facts and theories.

In calling attention, by questions and otherwise, to the more important phenomena to be observed and facts to be learned, the best features of the inductive system have been utilized. Especially is the writing of equations, which constitute the *multum in parvo* of chemical knowledge, insisted upon. As soon as the pupil has become imbued with the spirit and meaning of chemical equations, he need have little fear of failing to understand the rest. To this end Chapters IX., XI., and XVI. should be studied with great care. In the early stages of the work the equations may with advantage be memorized, but this can soon be discontinued. Whenever symbols are employed, pupils should be required to give the corresponding chemical names, or, better, both names and symbols.

The classification of chemical substances into acids, bases and salts, and the distinctions and analogies between each of these classes, have been brought into especial prominence. The general relationship between the three classes, and the general principles prevailing in the preparation of each, must be fully understood before aught but the merest smattering of chemical science can be known.

Chapters XV.—XXI. should be mastered as a key to the subsequent parts of the book.

The mathematical and theoretical parts of Chemistry it has been thought best to intersperse throughout the book, placing each where it seemed to be especially needed; in this way, it is hoped that the tedium which pupils find in studying consecutively many chapters of theories will be avoided, and that the arrangement will give an occasional change from the discussion of facts and experiments to that of principles. In these chapters additional questions should be given, and the pupil should be particularly encouraged to make new problems of his own, and to solve them.

It is needless to say that this treatise is primarily designed to be used in connection with a laboratory. Like all other text-books on the subject, it can be studied without such an accessory; but the author attaches very little value to the study of Chemistry without experimental work. The required apparatus and chemicals involve but little expense, and the directions for experimentation are the result of several years' experience with classes as large as are to be found in the laboratory of any school or college in the country. During the present year the author personally supervises the work of more than 180 different pupils in chemistry. This enables him not only to assure himself that the experiments of the book are practical, but that the directions for performing them are ample. It is found advisable to perform most of the experiments, with full explanation, in presence of the class, before requiring the pupils either to do the work or to recite the lesson. In the laboratory each pupil has a locker under his table, furnished with apparatus, as specified in the Appendix. Each has also the author's "Laboratory Manual," which contains on every left-hand page full directions for an experiment, with observations to be made, etc. The right-hand page is blank, and on that the pupil makes a record of his work. These notes are examined at the time, or subsequently, by the teacher, and the pupil is not allowed to take the book from the laboratory; nor can he use any other book

on Chemistry while experimenting. By this means he learns to make his own observations and inferences.

For the benefit of the science and the added interest in the study, it is earnestly recommended that teachers encourage pupils to fit up laboratories of their own at home. This need not at first entail a large outlay. A small attic room with running water, a very few chemicals, and a little apparatus, are enough to begin with; these can be added to from time to time, as new material is wanted. In this way the student will find his love for science growing apace.

While endeavoring, by securing an able corps of critics, and in all other ways possible, to reduce errors to a minimum, the author disclaims any pretensions to a work entirely free from mistakes, holding himself alone responsible for any shortcomings, and trusting to the leniency of teachers and critics.

The manuscript has been read by Prof. Henry Carmichael, Ph.D., of Boston, and to his broad and accurate scholarship, as well as to his deep personal interest in the work, the author is indebted for much valuable and original matter. The following persons have generously read the proof, as a whole or in part, and made suggestions regarding it, and to them the author would return his thanks, as well as acknowledge his obligation: Prof. E. J. Bartlett, Dartmouth College, N.H.; Prof. F. C. Robinson, Bowdoin College, Me.; Prof. H. S. Carhart, Michigan University; Prof. B. D. Halsted, Iowa Agricultural College; Prof. W. T. Sedgwick, Institute of Technology, Boston; Pres. M. E. Wadsworth, Michigan Mining School; Prof. George Huntington, Carleton College, Minn.; Prof. Joseph Torrey, Iowa College; Mr. C. J. Lincoln, East Boston High School; Mr. W. H. Sylvester, English High School, Boston; Mr. F. W. Gilley, Chelsea, Mass., High School; the late D. S. Lewis, Chemist of the Boston Gas Works, and others.

R. P. W.

Boston, January 3, 1888.

