

AN INTRODUCTION TO CHEMISTRY

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An introduction to chemistry by D. S. Macnair

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D. S. MACNAIR

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PREFACE

This book is intended to provide a laboratory course for beginners in chemistry—more particularly for pupils in secondary schools. It is desirable, though not absolutely necessary, that pupils using it should have previously gone through a course of practical work in measurements of area, volume, mass, density, etc., and should have at least a qualitative knowledge of the behaviour of gases to changes of pressure and temperature. The treatment adopted differs from that of most of the elementary text-books of the science. The aim of the author has been to lead the student by means of a connected series of simple experiments, *each of which is suggested by what has gone before and forms a link in a chain of reasoning*, to a knowledge of some of the most important principles of the science, to an understanding of some of the commonest of the phenomena which surround him in everyday life, and to an appreciation of the aims and methods of scientific research. It is hardly necessary to say that the experiments, or at least a large proportion of them, should be performed by the pupils individually. The importance of individual practical work is now fully recognised—indeed, there is nowadays some danger of too exclusive attention being given to practical work and too little to the constant questioning and discussion of results which ought to accompany it, and without which it may become almost as formal and soulless an exercise as the learning of lists of irregular verbs. A few experiments which require somewhat expensive apparatus, or which would be dangerous for beginners, have been specified as intended to be performed by the teacher only. The rest

are all within the capabilities of boys of fourteen or fifteen, and should, as a rule, be performed by the whole class. Care has been taken to keep the apparatus as simple as is consistent with accurate results, and it is hoped that the illustrations, nearly all of which have been specially drawn from photographs of the actual apparatus, will be found a reliable and useful guide to the teacher whose experience in the fitting up of apparatus is limited. A few of the experiments are new—at least to elementary text-books—and in several cases modifications have been suggested in the methods of carrying out well-known experiments which it is believed will be found to be improvements. As examples, the method of finding the quantitative composition of chalk described on pp. 73 and 74, the volumeter (p. 92), and the method of decomposing water by burning magnesium in steam (pp. 53 and 54) may be cited.

No attempt has been made to divide up the work into lessons or to indicate the time to be spent on the various sections, for this will vary in every school according to the ability of the pupils and the amount of time allotted to the subject. In schools where only three or four hours weekly are given to chemistry (and this is the minimum time for satisfactory work) it will probably be found that the first seven chapters will give sufficient material for a session's work. Where more time is given, the rate of progress will be correspondingly more rapid. It will be noticed that although no reference has been made to the atomic theory, formulæ and equations have been introduced in chapter ix. and have been freely used in the later chapters—not as expressing molecular changes, *but solely as a shorthand expression of the proportions by weight in which the elements are found by experiment to combine.* This use of equations is entirely independent of the atomic theory (Dalton's formulæ and equations were used by many of his contemporaries and successors who rejected his theory of atoms *in toto*), and it has such enormous advantages in assisting the memory, in bringing out analogies

between different classes of reactions, and in expressing the results of quantitative experiments in a form at once compact and easily comprehensible, that no intelligent teacher of chemistry who goes beyond the earliest steps can afford to reject it. That some teachers do so, and actually spend months on the teaching of the law of equivalent proportions without daring to introduce so much as the formula H_2O for water is probably due to a confused notion (for which encouragement may be found in many text-books) that an equation can have no meaning apart from what it implies as to the molecular constitution of the reacting substances.

The author's best thanks are due to his friend and former colleague, Mr D. E. Jones, B.Sc., for his kind assistance and for many valuable suggestions.

EDINBURGH, *June* 1902.