

**ONTARIO HIGH
SCHOOL CHEMISTRY;
PUPILS' TEXT - BOOK**

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ONTARIO HIGH SCHOOL CHEMISTRY

PUPILS' TEXT-BOOK

*Authorized by
The Minister of Education for Ontario*

Price 40 cents

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PREFACE

This book is published in two parts, in accordance with what is believed to be good pedagogical practice, viz.: To enable pupils to gain a knowledge of chemistry by *doing chemistry*, not simply by "getting it up." For this purpose it is intended that both parts of the book shall be in the hands of the scholars; and that when a topic is taken up the practical exercises relating to it shall be worked, as directed in the Manual, and the observations *necessary for the lesson* shall be recorded for reference. After the notes relating to the subject have been satisfactorily completed, it is expected that the teacher shall discuss the results with the class in a systematic way, and shall guide the pupils to proper conclusions in accordance with chemical laws and principles. In this connection the descriptive part of the Text-book will come into service.

Manifestly the pupils' note-book will be an important part of his material outfit, for it will form the connecting link between the exercises of the Manual and the description of the Text.

The Chemistry of the Middle School should serve a double purpose for the pupil who properly studies it. One of these aims at the development of that mental attitude called the scientific mind which investigates, weighs evidence, and forms judgments based on reason. The other consists in imparting to the student such a knowledge of the facts, the principles and the methods of the science that he will be able either to acquire further information of the same kind by independent reading, or to take up a more advanced course of chemical study.

Without doubt, the educational function is the more important one; and, while the two objects have some elements in common, there is yet divergence enough between them to cause hesitancy, at times, as to which of two courses is the preferable one to follow. Under such circumstances there must be some compromise between what is best and what is possible, especially when the work has to be curtailed to meet the requirements of a time limit.

It has been thought best to treat the subject in accordance with modern theory, and to introduce from the first the ideas and the terminology needed for that purpose, in order that the student may not have to discard, at a latter period, what he learns regarding chemistry in the High School. For these reasons the method of treatment and the choice of material will vary somewhat from those hitherto adopted. The present equipment of the schools, the relations of science to daily life, and the character and aims of secondary education in the province have all been considered in determining what shall be taken up in the course, and how it shall be dealt with.

Chemistry, though more particularly concerned with concrete materials, has almost the logical definiteness of mathematics, so that

educationally it is an excellent subject for securing closeness of observation, accuracy of reasoning, clearness of judgment and exactness of expression. The attraction that the study has for most pupils of secondary school age is easily accounted for by the opportunity it affords to solve problems by experiment, and by the easily observed phenomena that accompany chemical activity. The quantitative character of the reactions, and the fixed laws that govern chemical change, enable the teacher to take advantage of this partiality for the subject to secure valuable educational results, especially when pupils are at the age at which they are just passing beyond the stage of thinking in terms of the concrete.

It is assumed in this book that pupils have taken the Lower School Physics; and work that would be a repetition of that formerly done has been omitted. It is also taken for granted that there will be an instructor competent to direct the study, to drill on important points, to put stress where it is required, and to fill in details which he may think necessary. A text-book is of value as a guide to the work, as economising time for both master and students by system and condensation; but it is not a treatise embodying all that is known of the subject. It can not, in any sense, replace the teacher, because it is without personality, it can inspire no enthusiasm, and it lacks all emphasis. The experiments in the Manual are generally suitable for students' practice; but the varying facilities for this work in different schools will doubtless lead to some of the experiments being done by the teacher or by pupils under his direction. For this purpose the selections will not be the same in all cases, so the choice has been left with the teachers concerned. The text-book assumes these experiments to have been completed, and the observations recorded. The results are briefly discussed, their relationships pointed out, and necessary information supplied. The practical work done by the student must be constantly supervised by the teacher, because the value of an experiment does not lie in the noise and flare that it produces, but in what the student gets out of it that he can apply to the problem he is solving or to the investigation he is making.

The following principles should be observed regarding experimental work in class:

1. There should be no random work; every experiment should be undertaken for one definite purpose, *and only one*, and the student should know what problem he is seeking to solve, and what he is to note among the results observed. For this purpose, he should receive directions in the form of questions or hints. Further, it is all important that the experimenter should rely entirely on his observations, and that he should not discount his own work by having his mind made up regarding what should occur.

2. The accurate use of language should be rigidly insisted on to express exactly what is intended, neither more, nor less, nor anything else. Slovenly expression is no more to be tolerated than slovenly work.

3. Whatever tends to divert attention from the one thing sought should be avoided. All diffusion of either thought or effort is wasteful and injurious. If a second result of an experiment is wanted for

some other purpose, reference should be made to the notes, or the whole repeated, but with the new requirement as the object.

4. The notes that record the conditions of the experiment and the phenomena observed should be written by the pupils themselves, at the time of making the experiment, and without dictation or suggestion from the teacher. The note-book should be a register of the student's experiences, and entries should be made in it while the matters being described are still fresh in mind.

The value of an experiment is only slightly in the doing of it, mainly its worth lies in the discussion of the observations. The questions that accompany the directions for the experiments in the book are intended to be only suggestive, for such questions must of necessity be general in their character. The teacher should, therefore, take up the consideration of the problem from the point of view of the pupils' requirements and experiences as shown in what they have derived from the work done.

It is believed that most pupils taking this Middle School Course will get no further instruction in Chemistry; hence an effort has been made to connect this particular school work with the activities of life. This should be one of the main vitalising elements of the subject, and no opportunity should be missed of emphasising such relationships and applications, especially in connection with local conditions and industries. While these are important in their way, neither the commercial aspect of the study, nor mere knowledge of the details of the science, should be permitted to displace the effort to develop that attitude of mind which causes the pupil to observe accurately, to take account of essential conditions, and to draw proper inferences from them.

The sign of equality used to express chemical action has been, at times, replaced by an arrowhead. The latter is now a recognised symbol of chemical notation; students, therefore, should be familiar with its use. In this book it is employed in cases in which emphasis is directed to changes in substances rather than to equality of masses. If any excuse were required for its introduction, a sufficient one would be found in its common use to express reversible reactions.

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