LABORATORY EXPERIMENTS IN GENERAL CHEMISTRY

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HERMAN SCHLUNDT

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IN

GENERAL CHEMISTRY

By

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PREFACE

The experiments outlined in this manual are designed primarily for college students who have not had a course in chemistry in a preparatory school. The exercises represent the laboratory work of a comparatively brief introductory course in General Chemistry. The experiments are to be conducted under the guidance of an instructor, and are to be supplemented by class room demonstrations in connection with recitations from a text-book in General Chemistry for college students, or by illustrated lectures and text-book assignments.

Frequently the experiments do not furnish sufficient information to enable the student to answer some of the questions and make the explanations that are to appear in his notebook. The necessary information can generally be obtained from the text-book, and it is my plan to have the student use the text-book and laboratory outline as companion volumes in the laboratory. To facilitate the student's progress in this connection page references to two widely used texts have been inserted. My experience goes to show that the student will thus make very efficient use of his time, that he will give care and thought to his work, and that the laboratory work can be successfully made the central feature of instruction in the course.

In preparing the experiments, the substances chosen for study have purposely been limited to avoid scattering the student's efforts. Intensive, rather than extensive, study has been the underlying idea in selecting the exercises. Extended experiments on the metallic elements have not been included, as I feel that this work should be undertaken in Analytical Chemistry, and be allotted some of the time so largely used for laboratory practice in following a scheme of separations. I fully realize the value of practice in the identification of "unknown" substances, and this feature of laboratory work has been duly emphasized, and, it is hoped, in a manner which preserves its educational value. Emphasis has also been

placed upon the general reactions of acids, bases, and salts, the processes of oxidation and reduction, and chemical changes prominent in everyday life. My experience has been that the work outlined is adequate in scope as a preparation for more advanced courses in chemistry, and that it offers the cultural benefits of laboratory work to the student who wishes to take only elementary chemistry as a part of his college course. The benefits of laboratory work, of course, lie more in the hands of the instructor than in the pages of the book, and fully as much in the enthusiasm and spirit of inquiry of the student as in textbook matter and qualities of the teacher. In the pages of this little book I have sought throughout to enforce the scientific method of work. The educational value of the experiments will be realized by the student in so far as he succeeds in making the scientific method a life habit.

The majority of the experiments have been collected from various sources and modified in some respects by substitutions and additions of original material. Helps and suggestions to the student have been distributed in the form of notes with a view of encouraging him in his efforts, and gradually building up higher standards and ideals. The optional experiments are designed for the faster workers in the class, and will serve a very useful purpose in keeping the ambitious student from getting too far ahead of the recitation work of the class. The interest of the bright, quick student often flags, and the quality of his work deteriorates because he reads ahead of the class, and then fails to prepare the regular assignment. The chapter of elective experiments will be found of excellent service in this connection.

I am indebted to the Laboratory Outline of Alexander Smith for many ideas in laboratory instruction. I also desire to express my thanks to Mr. E. E. Morlan of this University for helpful suggestions in the selection of material for the experiments. Corrections and suggestions will be appreciated.

HERMAN SCHLUNDT.

University of Missouri, August, 1910.

GENERAL INSTRUCTIONS

1. Check the outfit of apparatus listed on the printed card in your locker. To do this, put all the articles on the top of the desk, then check and return such pieces as you can identify. Since articles missing, broken, or imperfect will be charged for when the course is completed, each piece as it is returned to the locker should be carefully examined, and any shortages or defective apparatus should be reported to an instructor. Place the test tubes in the rack provided for them, and arrange the glassware so that opening and closing the drawers will not break or damage the apparatus. Any unfamiliar articles may be checked with the aid of an instructor. Finally sign the card and hand it in at the store room.

2. Provide yourself with a notebook and make a careful permanent record of each experiment unless the directions state otherwise. Enter the numbers and titles of the experiments as they appear in this manual. Record what you observe in short, clear statements and at the time the observations are made. Having made a record of the observed facts, enter the conclusions you draw. Do not copy the directions, but direct your efforts to an intelligent interpretation of the data presented by the experiment, and then express your ideas in accurate terms.

3. Where an interrogation point, (?), or a direct question appears in the directions, a corresponding note should appear in the notebook. Oftentimes the experiment itself does not furnish sufficient data for answering some of the questions asked. The necessary information must then be sought by referring to a text-book. To save time in such cases page references to two well-known texts are given. K. refers to Kahlenberg's Outlines of Chemistry, and S. to Alexander Smith's General Chemistry for Colleges.

4. When the word (Instructions) appears, consult the instructor before going further.

5. The chemicals are divided into three sets, each arranged alphabetically according to the scientific names. The first set contains solids in bottles or jars, the second liquids in small bottles, and the third liquids in large bottles. The bottles and their places are numbered to facilitate correct replacement on the shelf, and particular care should be taken to return them to their proper places. Read the labels carefully, and you will not be using a sulphate where sulphite is required, or a concentrated acid where a dilute one should be employed.

6. All students work independently, except where the directions say "Two students working together."

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CHAPTER I.

APPARATUS.

1. The Bunsen Burner.

a. Unscrew the chimney and examine the construction of the burner. Make a drawing to scale showing the various parts.

Note 1. The purpose of drawings in the laboratory notebook is not to represent a picture of the apparatus, but to show its arrangement and operation. For this reason, and also for simplicity, sectional drawings or elevations are generally better than perspective effects. The student should aim at skill in making simple drawings rapidly and neatly with little or no use of a ruler.

b. Attach the burner by means of rubber tubing to the gas-tap, close the air-holes at the base, and light. Open the air-holes gradually and note the effect on the flame. (Size, shape, luminosity, steadiness.) Suggest a cause of the difference in the two flames. When the air-holes at the base of the burner are open the gas should burn with a noiseless blue flame.

c. Explore the non-luminous flame with a platinum wire to locate the relatively hotter and cooler parts. (?) Where should an object be held to get the greatest heating effect? Hold a match across the flame about 1 cm. above the top of the burner. (?) Show that unburnt gas exists in the inner cone by leading it out through a glass tube and lighting it. What region is deficient in air, and which has an excess? Make a scale drawing of the non-luminous flame showing its structure.

d. Try to vary the length of the flames. Can you obtain a luminous flame 2 cm. high? A non-luminous flame of the same height? How could the velocity of the gas in the chimney be changed without changing the pressure of the gas?