A TEXT-BOOK OF CHEMISTRY. A MODERN AND SYSTEMATIC EXPLANATION OF THE ELEMENTARY PRINCIPLES OF THE SCIENCE. ADAPTED TO USE IN HIGH SCHOOLS AND ACADEMIES

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ADAPTED TO USE IN

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BY

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NEW YORK:
CHARLES SCRIBNER & COMPANY.
1869.

PREFACE.

This volume is designed to be a *text-book of* Chemistry, suited to the wants of high schools and academies.

The author believes that the following features of his work adapt it to the purpose for which it was designed.

1. It contains no more than can be *mastered* by average classes in the time usually given to the study of Chemistry in the high schools and academies.

2. It is thoroughly systematized. The order and development of subjects is thought to be logical, and the arrangement of topics especially adapted to the best methods of conducting the exercises of the class-room.

3. It is written in accordance with modern theories, and no pains have been spared in the attempt to make it fairly represent the *present state* of the science as far as its elementary character will permit.

In addition to his attempt to make these features prominent, the author has not forgotten that a student will succeed best when required to learn *one thing at a time*. He believes that the difficulty often found by pupils in Chemistry does not lie in its laws, nor in its nomenclature, nor in its reactions, nor in any other one feature so much as in the illogical attempt to learn them all at once. He has therefore presented each one of these and other subjects separately and in natural order, like the successive steps of a ladder, leading to a height from which the pupil may have a clear view of the science.

Nor has he forgotten that Chemistry more than any other science rests upon experiment, that while its laws may be *explained* by certain theories, they are at the same time quite independent of such theories, being logical deductions from skillful and repeated experiment. He has

sought to present them as such, and while the student is enlightened by the synopsis of the paragraph (numbered in parenthesis) concerning the object of the experiments which he is about to study, the law itself is made to appear as the result to which the experiments have led him. Moreover, while the properties of bodies may be illustrated by experiments made without especial precautions, laws can be established only by experiments from which all sources of error have been eliminated. To such the student's mind is directed.

The work is not designed to do away with oral instruction, but rather to facilitate it. The synopsis of the paragraphs are *texts* which, taken together, give an outline of the entire subject, and which the lecturer will find it profitable to illustrate by descriptions and experiments of his own in addition to those given in the topics which the student studies.

The author finds it impracticable to name all the authorities to which he is more *or* less indebted. He must, however, gratefully acknowledge the assistance derived from Hoffmann's Introduction to Modern Chemistry, Roscoe's Lessons in Elementary Chemistry, and Cooke's Chemical Philosophy, Part I.

For cuts Nos. 29, 30, 32, and 36, the author is indebted to Muspratt's Applied Chemistry; for Nos. 53 and 54, to Atkinson's Ganot's Physics (London, 1867); all others are from his own drawings.

L. C. C.

ALBANY, *June*, 1869.

ANALYTICAL CONTENTS.

INTRODUCTION.—ON PHYSICAL AND CHEMICAL CHANGES.

All changes to which matter is subject are either *physical* or *chemical*.

Chemistry is the science which treats of the composition of matter and the *chemical* changes to which it is subject.

CHAP. I.—ON THE COMPOSITION OF BODIES.

All substances are either elements, compounds, or mixtures.

ELEMENTS.—Nitrogen.
Oxygen.
Hydrogen.
Carbon.
Nomenclature.
Symbols.

COMPOUNDS.—Pure water.
Carbonic dioxide.
ANALYSIS.—By Electricity.
By the Prism.
By Chemical Action.
SYNTHESIS.

MIXTURES.—Air.
Water.
Diffusion and Osmose.
Filtration, Evaporation, Distillation.

CHAP. II.—ON CHEMICAL ATTRACTION.

Attraction acting upon atoms of bodies under certain conditions and subject to definite laws produces all compound bodies.

- Conditions on which it acts.
- Laws which govern its action.
  - By Volume.
  - By Weight.
    - The Atomic Theory.
- The effect which it produces.
  - Compounds by Direct Combination.
  - Compounds by Substitution.
- Nomenclature of the compounds formed.
- Symbols representing composition and reactions.

CHAP. III.—ON CHEMICAL GROUPS.

Elements and compounds are so numerous that they must be studied in groups. That system is best which brings into the same group bodies whose properties are most nearly alike.

- The Non-Metals.
  - Quantivalence.
    - The Univalent or Chlorine group.
    - The Bivalent or Sulphur group.
    - The Trivalent or Nitrogen group.
    - The Quadrivalent or Carbon group.
- The Metals.
  - Metals of the Alkalies.
  - Metals of the Alkaline Earths.
  - Metals of the Earths.
  - The Zinc class.
  - The Iron class.
  - The Tin class.
  - The Tungsten class.
  - The Arsenic class.
  - The Lead class.
  - The Silver class.
  - The Gold class.

CHAP. IV.—ON DECOMPOSITION IN PRESENCE OF AIR.

Organic substances, or hydro-carbons from them, exposed to air under proper conditions of temperature and moisture may be decomposed, producing chiefly carbonic dioxide and water.

Combustion.
Heat.
Light.
Respiration.
Decay.

CHAP. V.—ON DECOMPOSITION IN ABSENCE OF AIR.

Organic substances from which air is wholly or in part excluded may be decomposed by the action of heat or moisture.

Destructive distillation.
Decay.

CHAP. VI.—ON DECOMPOSITION BY FERMENTS.

Many organic substances are decomposed by the presence of decaying organic matter which contains nitrogen.

The Alcoholic Fermentation.
The Acetous Fermentation.

CHAP. VII.—ON THE CHEMICAL ACTION OF LIGHT.

Decompositions.
Photography.
Solar and Stellar Chemistry.

CHAP. VIII.—ON THE CONSERVATION OF FORCE.