QUIZ COMPENDS. NO. 10. A COMPEND OF ORGANIC AND MEDICAL CHEMISTRY; INCLUDING URINARY ANALYSIS AND THE EXAMINATION OF WATER AND FOOD

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HENRY LEFFMANN

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BY

HENRY LEFFMANN, M.D., D.D.S.,

PROFESSOR OF CHEMISTRY AND METALLURGY IN THE PENNSYLVANIA COLLEGE OF DENTAL SURGERY, AND OF CLINICAL CHEMISTRY AND HYGIENE IN THE PHILADELPHIA POLYCLINIC.

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1884

PREFACE.

A work like the present can, of course, claim no originality. Here and there, perhaps, the author may contribute a fact or inference from his own experience, but the great bulk of the matter will be drawn from his library. The merits of such books lie only in the accuracy and perspicuity with which the facts of the science are detailed, and in the proper adjustment of the space assigned to different topics. In the following pages I have tried to meet these requirements; how far I have succeeded is for others to judge.

The compactness with which the book is printed has enabled a large amount of matter to be inserted; and I have sought to supplement this by using a somewhat condensed style, notably by following the example of Tidy, and expressing the composition and properties of groups of bodies in tabular form. But little space has been given to graphic formulæ.

The work will, I think, be found to contain a sufficient outline of organic and medical chemistry to serve the purpose of the student, especially one pursuing the study of medicine.

The usual care has been taken in the proof-reading, but, no doubt, errors have been overlooked. I am indebted to my assistant—Mr. William Beam—for aid in the preparation of the work. H. L.

S. E. Cor. 13th and Locust Sts.

April 30th, 1884.

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CONTENTS.

COMPEND

OF

ORGANIC AND MEDICAL CHEMISTRY.

NATURE OF ORGANIC BODIES.

Organic Chemistry is primarily the study of the substances which form part of the tissues of plants and animals. Not only are these very numerous, but by various influences, such as action of heat or of oxygen, many new bodies may be formed, and these new bodies are also included in organic chemistry. The great majority of the substances found in living things cannot be produced by artificial means. At the outset we must carefully distinguish between an ORGANIZED and an ORGANIC body. The former has a definite structure, generally cellular, and possesses the specific action known as vitality. Organic bodies, on the other hand, may have any structure, or be structureless. All organized bodies are organic, but all organic bodies are not organized. For the recognition of the organic nature of any substance the action of heat usually suffices. It causes decomposition, with evolution of smoky, strong-smelling vapors; a residue of carbon remains which can be burned off by heating strongly in the air. Sulphuric acid also produces a characteristic blackening, due to liberation of carbon. The presence of nitrogen is usually indicated by a disagreeable odor like that of burning wool. A more delicate test is by heating the body with an alkali, by which ammonia is formed. Organized bodies are in general easily recognized by the microscope.

The elements which enter into the formation of organic bodies are few in number. Carbon, hydrogen, nitrogen and oxygen are by far the most frequent; sulphur, phosphorus and iron are found to a limited extent, principally in the most highly organized tissues of animals. During the last twenty-five years many artificial bodies have been formed, in which elements such as mercury, bismuth, arsenic, chlorine and iodine have been introduced; these, although analogous to the more natural organic bodies, are not capable of forming part of the healthy tissues. Carbon is present in

almost all organic bodies, and for this reason organic chemistry has sometimes been called the "chemistry of the carbon compounds." Hydrogen is also almost always present; oxygen somewhat less frequently; nitrogen still less frequently; while sulphur, phosphorus and iron are rather exceptional in their occurrence. The following table gives a list of bodies belonging to different classes in organic chemistry, and shows how many changes may be made in the combinations of these few elements. The compounds all occur ready formed in nature:—

$C_{10}H_{16}$ .....Oil of turpentine.
$C_{12}H_{22}O_{11}$.....Cane sugar.
$C_{10}H_{14}N_2$.....Nicotine (from tobacco).
$C_{17}H_{19}NO_3$.....Morphine (from opium).
$C_2H_7NSO_3$.....Taurine (from bile).
$C_3H_9PO_6$ .....Phospho-glyceric acid (from brain).
$C_{32}H_{32}FeN_4O_4$ .....Hæmatine (from blood).

Proximate and Ultimate Composition. The tissues of plants and animals, or the products of their decomposition, are generally mixtures of several independent substances. Thus butter is a mixture of four or five fats; common rosin contains two or sometimes three distinct bodies; opium and Peruvian bark are still more complicated, and brain and muscle structures are so complicated that as yet perfect analyses have not been made of them. The substances which thus exist naturally together in a state of mixture are called PROXIMATE PRINCIPLES, the separation and identification of them is called PROXIMATE ANALYSIS, and such of them as give characteristic qualities to the articles in which they occur are generally called ACTIVE or ESSENTIAL PRINCIPLES; atropine, for instance, is the active principle of belladonna, for although many different bodies are contained in the belladonna leaf, atropine is the one upon which its physiological activity depends. The ULTIMATE PRINCIPLES of a substance are the elements (carbon, hydrogen, etc.) which it contains.

Ultimate analysis, that is the determination of the proportions of the elements that may be present, although requiring care in manipulation, is practically the same for all organic compounds. It consists in burning the body in a full supply of oxygen, by which the carbon is converted into carbon dioxide and the hydrogen into water. These may be collected and weighed, and the amounts of carbon and hydrogen corresponding to these weights may be easily determined by calculation. Oxygen, if present, is generally determined by the difference between the weight of the original body and the sum of the weights of the carbon and hydrogen; nitrogen, chlorine, sulphur, or other less common