

**A HAND-BOOK OF
CHEMISTRY: WITH
NINETEEN ILLUSTRATIONS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649436354

A Hand-Book of Chemistry: With Nineteen Illustrations by Francis Gurney Smith & John Neill

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

FRANCIS GURNEY SMITH & JOHN NEILL

**A HAND-BOOK OF
CHEMISTRY: WITH
NINETEEN ILLUSTRATIONS**

H A N D - B O O K
or
C H E M I S T R Y.

HAND-BOOK
OF
CHEMISTRY:

With Nineteen Illustrations.

BEING A PORTION OF
AN ANALYTICAL COMPENDIUM
OF THE
VARIOUS BRANCHES OF MEDICINE.

BY

JOHN NEILL, M. D.,

DEMONSTRATOR OF ANATOMY IN THE UNIVERSITY OF PENNSYLVANIA, LECTURER
ON ANATOMY IN THE PHILADELPHIA MEDICAL INSTITUTE, ETC.,

AND

FRANCIS GURNEY SMITH, M. D.,

LECTURER ON PHYSIOLOGY IN THE PHILADELPHIA ASSOCIATION FOR MEDICAL INSTRUCTION,
PHYSICIAN TO THE ST. JOSEPH'S HOSPITAL, ETC.

SECOND EDITION, REVISED AND IMPROVED.

PHILADELPHIA:
BLANCHARD AND LEA.

1852.

CONTENTS.

PRELIMINARY OBSERVATIONS.

	PAGE
Physical forces, - - - - -	18
Cohesion, - - - - -	18
Chemical affinity, - - - - -	18
Gravitation, - - - - -	13
Capillarity, - - - - -	14
Endosmose, - - - - -	14
Diffusibility of gases, - - - - -	14
Physical condition of the atmosphere, - - - - -	15
The barometer, - - - - -	15
Specific gravity, - - - - -	16

PART I.

IMPONDERABLE SUBSTANCES.

SECTION I.—CALORIC.

Latent heat, - - - - -	18
Effects of caloric—Expansion, - - - - -	19
Thermometers, - - - - -	20
Communication or transfer of heat, - - - - -	21
Conduction of heat, - - - - -	21
Radiation of heat, - - - - -	21
Reflection of heat, - - - - -	22
Transmission of heat, - - - - -	22
Vaporization, - - - - -	23
Evaporation, - - - - -	24
Specific heat, - - - - -	25
The spheroidal condition, - - - - -	25

SECTION II.—LIGHT.

Theories of light, - - - - -	26
Refraction and reflection of light, - - - - -	26
Chemical effects of light, - - - - -	27

	PAGE
SECTION III.—ELECTRICITY.	
Electrical machine, - - - - -	28
Leyden jar, - - - - -	29
Electrical induction, - - - - -	29
Electrometers and Electroscopes, - - - - -	30
SECTION IV.—GALVANISM OR VOLTAIC ELECTRICITY.	
Galvanic or voltaic circuits, - - - - -	31
Theories of galvanism, - - - - -	32
Effects of galvanism, - - - - -	32

PART II.

INORGANIC CHEMISTRY.

CHAPTER I.

Chemical nomenclature, - - - - -	34
Chemical affinity, - - - - -	36
The atomic theory, - - - - -	37
SECTION I.—SIMPLE NON-METALLIC BODIES.	
Oxygen, - - - - -	38
Theory of combustion, - - - - -	39
Hydrogen, - - - - -	40
Water, - - - - -	41
Nitrogen, - - - - -	42
Compounds of nitrogen with oxygen, - - - - -	43
Carbon, - - - - -	44
Compounds of carbon with oxygen, - - - - -	45
Sulphur, - - - - -	46
Compounds of sulphur and oxygen, - - - - -	47
Selenium, - - - - -	48
Phosphorus, - - - - -	48
Compounds of phosphorus and oxygen, - - - - -	49
Boron, - - - - -	50
Silicon, - - - - -	50
Chlorine, - - - - -	51
Compounds of chlorine with oxygen, - - - - -	52
Iodine, - - - - -	52
Bromine, - - - - -	53
Fluorine, - - - - -	53
COMPOUNDS OF SOME OF THE FOREGOING SUBSTANCES WITH EACH OTHER.	
Hydrochloric, or muriatic acid, - - - - -	54
Hydriodic acid, - - - - -	54
Hydrobromic acid, - - - - -	54
Hydrofluoric, and fluosilicic acid, - - - - -	55
Hydrogen and nitrogen—ammonia, - - - - -	55
Hydrogen and sulphur—hydrosulphuric acid, - - - - -	56
Hydrogen and phosphorus—phosphuretted hydrogen, - - - - -	57
Compounds of carbon and hydrogen, - - - - -	57
Compounds of nitrogen and carbon, - - - - -	59
Cyanogen and hydrogen—prussic acid, - - - - -	59
Cyanogen and oxygen, - - - - -	60

CHAPTER II.

METALS.

	PAGE
SECTION I.—GENERAL PROPERTIES OF METALS, - - - - -	60
SECTION II.—SALTS, - - - - -	61
SECTION III.—OXY-SALTS, - - - - -	64
Sulphates, - - - - -	64
Nitrates, - - - - -	64
Chlorates, - - - - -	65
Iodates, - - - - -	65
Phosphates, - - - - -	65
Carbonates, - - - - -	65
Arsenites, and Arseniates, - - - - -	65
Chromates, - - - - -	66
Borates, - - - - -	66
SECTION IV.—HYDROSALTS, - - - - -	66
SECTION V.—SULPHUR SALTS, - - - - -	67
SECTION VI.—DOUBLE HALOID SALTS, - - - - -	67

CHAPTER III.

CLASSIFICATION OF THE METALS.

SECTION I.—METALS OF THE ALKALIES.	
Potassium, - - - - -	68
Salts of potash, - - - - -	69
Sodium, - - - - -	70
Salts of soda, - - - - -	70
Lithium, - - - - -	71
Ammonium, - - - - -	71
Salts of Ammonia, - - - - -	71
SECTION II.—METALS OF THE ALKALINE EARTHS.	
Barium, - - - - -	71
Strontium, - - - - -	72
Calcium, - - - - -	72
Salts of lime, - - - - -	72
Magnesium, - - - - -	73
Salts of magnesia, - - - - -	73
SECTION III.—METALS OF THE EARTHS.	
Aluminium, - - - - -	73
Alum, - - - - -	74
SECTION IV.—METALS PROPER.—Order 1. Metals whose Oxides form powerful Bases.	
Iron, - - - - -	74
Copper, - - - - -	76
Lead, - - - - -	77
Zinc, - - - - -	78
Cadmium, - - - - -	79
Bismuth, - - - - -	79
Manganese, - - - - -	80
Nickel and Cobalt, - - - - -	80
Uranium, and Cerium, - - - - -	80

	PAGE
SECTION V.—Order 2. Metals whose Oxides form weak Bases, or Acids.	
Tin, - - - - -	81
Antimony, - - - - -	81
Arsenic, - - - - -	82
Chromium, Vanadium, Tungsten, Molybdenum, Columbium, Titanium, Tellurium, and Osmium, - - - - -	84
SECTION VI.—Order 3. Metals whose Oxides are reduced by heat.	
Gold, - - - - -	84
Silver, - - - - -	85
Platinum, - - - - -	85
Mercury or quicksilver, - - - - -	86

PART III.

ORGANIC CHEMISTRY.

GENERAL OBSERVATIONS, - - - - -	87
SECTION I.—COMPOUND RADICALS, - - - - -	88
SECTION II.—ANALYSIS OF ORGANIC BODIES, - - - - -	90
SECTION III.—VEGETABLE NON-AZOTIZED SUBSTANCES.	
Gum, - - - - -	91
Sugar, - - - - -	91
Fecula or starch, - - - - -	92
Lignin or cellulose, - - - - -	92
SECTION IV.—PRODUCTS ARISING FROM CHEMICAL REACTIONS IN THE PRECEDING SUBSTANCES.—ACTION OF NITRIC ACID, - - - - -	93
Vinous fermentation—Alcohol, - - - - -	93
Action of acids on alcohol—Ether, - - - - -	94
Action of oxygen on alcohol—Acetyle, and its compounds, - - - - -	96
SECTION V.—Substances resembling alcohol,	
Methyls, and its compounds, - - - - -	98
Formyle, and its compounds, - - - - -	98
Amyls, and its compounds, - - - - -	99
SECTION VI.—Organic Acids.	
Acetic acid, - - - - -	99
Citric acid, Malic acid, - - - - -	99
Lactic and Tartaric acid, - - - - -	100
Salts of tartaric acid, - - - - -	100
Tannic acid, - - - - -	100
Gallic acid, Formic acid, Benzoic acid, Meconic acid, - - - - -	101
SECTION VII.—VEGETABLE ALKALIES, - - - - -	101
SECTION VIII.—AZOTIZED VEGETABLE SUBSTANCES, - - - - -	103
SECTION IX.—OILS AND FATS,	
Resins and Balsams, - - - - -	105
SECTION X.—ANIMAL COMPOUNDS, - - - - -	105

CHEMISTRY.

PRELIMINARY OBSERVATIONS.

PHYSICAL SCIENCE, in its most extended sense, comprises the two great divisions of *Natural History* and *Natural Philosophy*. The former includes Anatomy, Zoology, Botany, and Mineralogy; the latter embraces Chemistry, Geology, Physiology, and Mechanics.

CHEMISTRY may be defined to be the science which investigates the molecular changes of bodies; or more strictly, that which treats of the laws that relate to chemical attraction.

The whole material world is subject to *Force*; this it is which produces change in bodies. Two great opposing forces appear to exist,—Attraction and Repulsion: the *cause* of either is unknown, and purely speculative. Bodies are either solid, liquid, or gaseous, according as one or other of these two forces preponderate; thus, if the molecules of a body adhere with a force called *cohesion*, so that an exterior power is required to separate them, the body is termed a *solid*; if the cohesion is only such as to allow the particles to move upon each other, it is named a *liquid*; and if the particles are kept apart by a repulsive force (supposed to be Caloric), it is denominated a *gaseous* body.

Attraction comprises several species or subdivisions, as Cohesion, Chemical Attraction or Affinity, Gravitation, Capillarity, and Endosmose.

Cohesion.—This is the attraction between homogeneous particles. It is only exerted at insensible distances, the molecules never being in absolute contact, otherwise the property of *elasticity* could not exist, since this requires space for the molecules to move in.

Chemical Attraction or Affinity.—This is the attraction between heterogeneous particles. Like cohesion, it is exerted only at inappreciable distances; in other words, apparent contact must take place.

Gravitation.—This attractive force is displayed between masses, and at sensible distances. It gives weight to bodies, and it is the