CHEMICAL PROBLEMS AND REACTIONS: TO ACCOMPANY STÖCKHARDT'S ELEMENTS OF CHEMISTRY

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649539192

Chemical Problems and Reactions: To Accompany Stöckhardt's Elements of Chemistry by Josiah P. Cooke

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

JOSIAH P. COOKE

CHEMICAL PROBLEMS AND REACTIONS: TO ACCOMPANY STÖCKHARDT'S ELEMENTS OF CHEMISTRY

Trieste

CHEMICAL

PROBLEMS AND REACTIONS,

TO ACCOMPANY

Julius Adolph
STÖCKHARDT'S ELEMENTS OF CHEMISTRY.

BY

JOSIAH P. COOKE, Jr.

CAMBRIDGE:
PUBLISHED BY JOHN BARTLETT,
Bookseller to the University.
1857.

PREFACE.

THIS book has been prepared solely for the use of the undergraduates of Harvard College. It contains a collection of chemical problems and reactions, with references to the sections of Stöckhardt's Elements of Chemistry, and also a few chapters on the chemical nomenclature and the use of chemical symbols, subjects which are not sufficiently developed in that text-book for the purposes of college instruction. In writing chemical symbols the author has adopted a uniform system throughout the volume, which, as he hopes, will be found to be at once expressive and clear. The problems and reactions cover the Inorganic portion of Stöckhardt's Elements; the problems have only been extended to the section on the Heavy Metals. Beyond this, the reactions alone have been given, as it was supposed that, before reaching this section, the student will easily be able to propose problems for himself. In solving many of the problems it will be found convenient to use logarithmic tables of four places, which, with several other tables, will be found at the end of the volume. The student is advised to remove the tables of logarithms, and paste them for use on a card. The difficulty of insuring complete accuracy in the printing of chemical formulæ can be known only to those who have had to see a book of this kind through the press. Several errors have been already discovered, and corrected, but others unquestionably exist.

CAMBRIDGE, *May 15th*, 1857.

NOMENCLATURE OF CHEMISTRY.

Origin of the Nomenclature. — Previous to the year 1787 the names given by chemists or alchemists to substances were not conformed to any general rules. Many of these old names, such as *Oil of Vitriol, Calomel, Corrosive Sublimate, Red-Precipitate, Saltpetre, Liver of Sulphur, Cream of Tartar, Glauber's and Epsom Salts,* are still retained in common use. As chemical science advanced, and the number of known substances increased, it became important to adopt a scientific nomenclature. The admirable system now in use is due almost entirely to Lavoisier, who reported to the French Academy on the subject, in the name of a committee, in 1787. This system, now known as the Lavoisierian nomenclature, was generally adopted by scientific men soon after its publication, and has not been materially modified since. In it the name of a substance is made to indicate the composition.

Names of the Elements. — The names of the elements are the only ones which are now independent of any rule. Those which were known before the adoption of the nomenclature,

such as Sulphur, Phosphorus, Iron, Lead, retain their old names. Several of the more recently discovered elements have been named in allusion to some prominent property or some circumstance connected with their history; as, *Oxygen* from ὀξύς, γεννάω (acid-generator); Hydrogen, from ὕδωρ, γεννάω (water-generator); Chlorine, from χλωρός (green); Iodine, from ἰωδής (violet); Bromine, from βρῶμος (fetid odor), &c. The names of the newly discovered metals have a common termination, *um*, as Platinum, Potassium, Sodium; and the names of a class of the metalloids terminate in *ine*, as Chlorine, Bromine, &c.; but except in these respects the names of the elements are entirely arbitrary.

Classification of Compounds. — There are three orders of chemical compounds: — 1st, *Binary Compounds*, consisting of two elements, or of the representatives of two elements; 2d, *Ternary Compounds*, consisting of three elements, or of their representative; and 3d, *Quaternary Compounds*, consisting of four elements, or their representatives. There are some chemical compounds containing more than four elements; but in most cases two or more of these elements are representatives, i. e. occupy the place, of only one, as will be explained farther on. Binary compounds are subdivided into two classes, *Electro-Positive Binaries*, or *Bases*, and *Electro-Negative Binaries*, or *Acids*. Each of these classes is distinguished by a peculiar set of properties, or at least this is the case with the prominent members of either class; but the two classes merge so gradually into each other, that it is impossible to draw a line of demarcation between them; and there is a large class of intermediate compounds, which either partake of the proper-

ties of both, or are entirely indifferent. Indeed, the binary compounds may best be regarded as forming a continuous series of substances, varying in their properties from those of strong acids on the one hand to those of strong bases on the other, and with every possible grade of qualities between the two extremes. In this series each binary may be considered as an electro-positive compound or base towards all those which precede it, and as an electro-negative compound or acid towards all those which follow it. Ternary compounds are generally, at least in Inorganic Chemistry, composed of two binaries, i. e. of an acid and a base, and are then called Salts. The quaternary compounds are generally composed of two salts, and are called Double Salts.

Names of Binaries. — The most important binaries, as well as those which have been the best studied, are the compounds of oxygen with the other elements. To these the generic term Oxide has been applied. The electro-positive binaries are called simply Oxides of the elements of which they consist. Thus we have

Oxide of Hydrogen, consisting of oxygen and hydrogen.
Oxide of Potassium, " " " potassium.
Oxide of Sodium, " " sodium.

When the name of the metal ends in *um*, the name of the compound with oxygen is frequently formed by changing this termination into *a*, with such other modifications of the terminal letters as euphony may require. Thus we use, instead of

Oxide of Sodium, Soda.
Oxide of Potassium, Potassa.

Oxide of Calcium,	Calcia (or Lime).*
Oxide of Barium,	Baryta.
Oxide of Strontium,	Strontia.
Oxide of Magnesium,	Magnesia.
Oxide of Aluminum,	Alumina.

The two names are in all cases synonymous. Generally oxygen combines with an element in more than one proportion; then, in order to distinguish between the different oxides of the same element, we use various Latin and Greek prefixes, such as *sub*, *proto*, *sesqui*, *deuto*, *hyper*. This is well illustrated by the names of the different oxides of mercury and manganese, which are as follows.

Names.	Composition. Mercury.	Oxygen.
*Sub*oxide of Mercury	100	4
*Proto*xide of Mercury	100	8
	Manganese.	Oxygen.
*Proto*xide of Manganese	27.6	8
*Sesqui*oxide of Manganese	27.6	12
*Hyper*oxide of Manganese	27.6	16

The electro-negative binary compounds of oxygen (the acids) are named on a different principle. These are called different kinds of acids. If the element forms but one acid with oxygen, the name is formed by adding to the name of the acid the termination *ic*, with such changes of the final letters as euphony may require. Thus, carbon and oxygen form Carbon*ic*

* The common name *Lime* is much more frequently used than either of its scientific synonymes, Oxide of Calcium, or Calcia. Indeed, the last has never been in general use.

Acid. When the element forms two acids, by combining with different amounts of oxygen, the termination *ic* is reserved for that containing the most oxygen, while the termination *ous* is given to the other. We have, for example,

	Arsenic.	Oxygen.
Arseni*ous* Acid	75	24
Arseni*c* Acid	75	40

	Phosphorus.	Oxygen.
Phosphor*ous* Acid	32	24
Phosphor*ic* Acid	32	40

If oxygen combines with an element in more than two proportions, to form acids, the names are formed with the Greek prefix *hypo*, indicating a less, or the Latin prefix *per*, indicating a greater, amount of oxygen than that contained in the acids to whose names they are prefixed. The acid compounds of sulphur and oxygen are

	Sulphur.	Oxygen.
*Hypo*sulphur*ous* Acid	16	8
Sulphur*ous* Acid	16	16
*Hypo*sulphur*ic* Acid	16	20
Sulphur*ic* Acid	16	24

The acid compounds of chlorine and oxygen are

	Chlorine.	Oxygen.
*Hypo*chlor*ous* Acid	35.5	8
Chlor*ous* Acid	35.5	24
*Hypo*chlor*ic* Acid	35.5	32
Chlor*ic* Acid	35.5	40
*Per*chlor*ic* Acid	35.5	56

Very frequently the higher degrees of oxidation of an ele-