

THE ORIGINS
OF
CHEMICAL
NAMES

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OLDBOURNE
LONDON

OLDBOURNE BOOK CO. LTD.
121 Fleet Street, London, E.C.4.

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PRINTED IN GREAT BRITAIN BY
SPOTTISWOODE, BALLANTYNE AND CO. LTD.
LONDON AND COLCHESTER

ACKNOWLEDGEMENTS

In collecting and preparing the material for this book I have consulted (in addition to many original papers) the various Oxford dictionaries, *Webster's New International Dictionary*, certain foreign dictionaries, chemical dictionaries and encyclopaedias, and many textbooks and histories of chemistry. My thanks are due to the authors and publishers of all these works, for without the information thus made available this book could not have been written.

W. E. F.

FOREWORD

OVER a million different chemical compounds are known. Each has its own distinctive name. The primary purpose of a name is identification; it is the label by which one substance is distinguished from another so that unambiguous reference may be made to it. Many chemical names also have a further function; they describe the composition and structure of the substances which they denote. A few of the names are of ancient origin; many are comparatively new. Some, because they are derived from, or built up from, elements with which we are familiar, seem sensible and appropriate, but others, of strange or curious formation, we accept and use with little regard for their origins. There are times when it is interesting and refreshing to lay rigorous chemical studies aside and to explore some of the wider fields of the subject. One such field is chemical nomenclature. What are the origins of the names which we use?

Why were the curious names *dysprosium* and *praseodymium* given to two of the "rare earth" elements? Why is a sodium ammonium phosphate commonly known as *microcosmic salt*? How did *alcohol* get its name? Who invented the term *ethyl*? Why did Runge give the name *pyrrol* to a new compound which he detected in coal-tar? What connection has *mesitylene* with a "go-between" (Gk. *mesitēs*) or the *tropaeolines* with a trophy of war (Gk. *tropaion*)? What are the origins of the familiar suffixes *-ate*, *-ide* and *-ite*? Who introduced the prefixes *ortho-*, *meta-* and *para-* in the naming of di-substitution derivatives of benzene? And why was *benzene* itself so called?

These are a few of the many questions which could be asked about the origins of chemical names. It is such questions which this book tries to answer. An enquiry into the origins of the names, and a knowledge of the answers, may seem to be of little practical value—we can be good chemists without having the remotest idea why phenol (for example) is so called—but life would be poor indeed if we could find no interest or pleasure in anything other than the strictly utilitarian. Chemical names have grown up with the development of the subject; they are part of its history. Some recall the mysteries of alchemy, some the uncertain knowledge of the chemical pioneers. The flood of new names during the last century and a half, their ever-growing number, their forms, and the order in which they appeared tell, in a peculiar but fascinating way, the story of chemical progress.

It is impossible within any book of reasonable size to include the details of every chemical name. Fortunately many thousands of the names have

been constructed from a much smaller number of simpler units and their origins are explained by the origins of these units. Even so, some selection has been necessary. Further, chemistry has no rigid boundary. It overlaps a number of related sciences (e.g. biochemistry, mineralogy) and impinges upon a large number of applied sciences (e.g. metallurgy, pharmacy). In making the selection, the names of a fair number of minerals have been included because the student of chemistry will encounter these names in his textbooks but, in general, the specific names of alloys, drugs, dyes, plastics, and other commercial products (other than a few in "household" use) have been omitted. Some names of an earlier age, e.g. *sal ammoniac*, *muratic acid*, *aetherin*—names which are outside the modern system of nomenclature or even wholly obsolete—have been included for their historical interest.

The first glossary includes the names of all the chemical elements (natural and artificial) known at the time of writing together with some notes on the circumstances in which the elements were discovered. The second glossary, which is devoted to compounds, minerals and other substances, contains over 1700 major headings. Some headings embrace a number of related compounds. The glossary also includes the affixes and combining-units from which many other names have been constructed. The book thus effectively explains the origins of many thousands of names.

In order that the names may be seen in their historical setting, the introductory section includes a brief outline of the development of chemistry. Historical references are also made within the glossaries. Some biographical notes on the more important of the chemists to whom reference has been made are provided in the appendix.

CHEMICAL SUBSTANCES AND THEIR NAMES

Elements and atoms

The ancient Greeks believed that all natural matter was compounded of the four "elements" Earth, Air, Water and Fire. There were some who interpreted these elements literally but others, and especially their followers in later centuries, regarded them in a more symbolic sense. Aristotle (384–322 B.C.) taught that every substance was a compound of matter and "essence". The prime matter was featureless; it served as the basis for the elements or qualities which conferred on each substance its individuality.

The alchemists, notably Geber (8th century), felt that Aristotle's four elements were inadequate to explain the peculiar qualities of metals and they postulated that the metals were derived from mercury and sulphur. Some believed this literally, but for others the terms *mercury* and *sulphur* stood for certain idealized substances or qualities. Paracelsus (1493–1541) attempted to extend the mercury-sulphur theory to all types of matter by adding another element "salt". Up till the 18th century it was generally believed that all matter was compounded of some selection of the four elements of Aristotle and the three of Paracelsus.

Robert Boyle (1627–91), who was mainly responsible for establishing chemistry as an independent science, stressed the importance of rigorous experimental examination before accepting alleged facts or theories. He realized that progress was hindered by a lack of clear definitions. He rejected the seven elements (which by then no one could clearly define) as the ultimate constituents of matter for he could find no satisfactory evidence that matter could be resolved into them. He was aware that whereas some substances, e.g. green vitriol, could be decomposed into other substances, there were others, e.g. copper, which could not be so decomposed. He maintained that any substance must be regarded as an element if no means were known of resolving it into simpler parts. He left no list of the substances which he regarded as elements and the ideas of Aristotle and Paracelsus persisted into the next century.

Lavoisier (1743–94) revived and re-emphasized Boyle's concept of an element. In his *Traité Élémentaire de Chimie* (1789) he gave a list of 33 "elements" of which 26 are still regarded as elements today.* During

* His list included Light, Caloric (heat), and certain "earthy" substances (e.g. lime, silica), though he suspected that the earthy substances might prove to be oxides. He omitted the fixed alkalis potash and soda for, although he could not decompose them, he felt sure that they were compound.

the first half of the 19th century a large number of new substances were discovered and examined. By 1860 the number of known elements had risen to 60. Today about 90 naturally occurring elements are recognized.

Although the "official" view, held for many centuries, was that matter was homogeneous and infinitely divisible, a contrasting theory first put forward by Democritus (470–380 B.C.) had never become quite extinct. He held that matter consists of tiny, unalterable, indivisible particles and that matter cannot be divided more finely than into these particles. The indivisible particles came to be known as *atoms* (from Gk. *a-*, not, *temnō*, to cut). From about 1600 onwards there was increasingly strong evidence for the truth of the "atomic theory". It was revived by Boyle and accepted by Newton. In the first decade of the 19th century John Dalton took the important step of making definite assertions about atoms. All the atoms of a given element, he said, were indivisible, alike and equal; atoms of different elements differed in their properties (e.g. weight, affinity); compounds were formed by the union of atoms in simple numerical proportions (to form "compound atoms", i.e. molecules). Thus the foundation of the modern atomic theory of chemistry was laid.

By the middle of the 19th century enough elements were known, their properties examined, and (for most) their relative atomic weights determined, for certain interrelationships to become apparent. In particular, it was found that if the elements are arranged in the serial order of their atomic weights, there is a rhythmic or "periodic" variation in their properties. This observation was crystallized by Mendeléeff* who, in 1869, formulated his "periodic law" and constructed a Periodic Table.

In the Periodic Table the elements are arranged in horizontal rows in the order of their atomic weights; elements of the same family or group then fall in the same vertical columns. In order to make his Table "work", Mendeléeff found it necessary to leave certain gaps in the sequence of elements. He predicted that new elements would eventually be discovered and would be found to fill these gaps. He named the "missing" elements by adding the prefix *eka-* or *dvi-* (Sanskrit *one* and *two*) to the names of the known elements which, he said, they would be found to resemble. Thus a predicted element resembling silicon he called *eka-silicon*; two possible analogues of manganese he called *eka-manganese* and *dvi-manganese*. The eventual discovery of the missing elements, and of the whole group of "inert" gases (helium, argon, etc.) which fitted into place as a completely new column, showed that the Periodic Table was not the result of chance but of a fundamental property of matter.

* There are several variant English spellings of this Russian name.

In the closing years of the 19th century three important discoveries initiated a series of interrelated discoveries which revolutionized man's understanding of the constitution of matter. These were the discoveries of X-rays, of the electron,* and of radioactivity. A new era of atomic science had dawned.

An atom is now envisaged as consisting of a central nucleus, which is positively charged and accounts for most of the mass, with electrons, of negative charge and almost negligible mass, travelling in orbits about it. The nucleus of a normal atom of hydrogen consists of a simple positively charged particle known as a proton†; the nucleus of the atom of any other element is built up from protons and uncharged particles of similar mass known as neutrons.‡ The appropriate number of electrons are in orbit about the nucleus so that the atom as a whole is electrically neutral.

The nuclear charge is the fundamental quantity which distinguishes the atom of one element from that of another. It advances from 1 for hydrogen, 2 for helium, . . . to 92 for uranium. The numerical value of the charge, which is also the serial number of the element, is known as the *atomic number*. As a nucleus must contain an integral number of protons, there can only be 92 different elements from hydrogen to uranium inclusive. All these 92 elements have now been discovered though probably two or three of them do not occur naturally in appreciable amounts.

The number of neutrons in the nucleus affects the mass of the atom but not its distinctive chemical properties. Variant forms of most atoms exist which differ in the number of neutrons. These variant forms are indistinguishable chemically and represent the same element; they are put in the same place in the Periodic Table. They are therefore known as *isotopes*‡ (from Gk. *iso-*, *isos*, equal, same, *topos*, place).

By the bombardment of atoms of high atomic number with fast moving particles (e.g. helium nuclei) it has been possible to build up nuclei which are more complex than those of the natural elements. All these artificial elements are radioactive and break down into simpler forms. As their atomic numbers are higher than those of uranium they are called the *transuranic elements* (L. *trans*, across, to or on the other side). This book records eleven such elements but possibly by the time it appears in print the discovery, or rather synthesis, of other new elements will have been reported.

* The term *electron* is a back-formation from *electric(ity)*, itself derived from Gk. *lektron*, amber.

† *Proton*—from Gk. *prōtos*, first, fundamental; *neutron*—from *neutral*. The suffix *-on*, which occurs in the names of various atomic particles, was taken from *electron*.

‡ Originally the term *isotope* was applied to a form which differed from the dominant form; it is now commonly applied to all the forms of an element.

The naming of the chemical elements

A few of the elements, because they occur naturally or are very easily obtained from their ores, have been known from very early times. The ancient Greeks were acquainted with nine substances which are now recognized as elements: the two non-metals sulphur and carbon, and the seven metals copper, gold, iron, lead, mercury, silver and tin. The ultimate origins of the various names given to these substances are lost in history. There is also some doubt about the origins of the names of some other elements, e.g. antimony, zinc, which were discovered in the age of alchemy.

Towards the end of the 18th century chemists began to give serious attention to the naming of their substances (p. xvii). Lavoisier formed the name *carbon* (Fr. *carbone*) from the Latin word for coal and invented the names *oxygen* and *hydrogen* (Fr. *oxygène*, *hydrogène*) with the deliberate intention of indicating something of the chemical properties of the substances. The Swedish chemist Berzelius, who recognized the value of logical naming, proposed (in 1811) that the names of the elements should all be Latin in form. A number of names already given to metallic elements, e.g. *uranium*, *chromium*, *barium*, were of this form. He used the Latin names *ferrum*, *stannum* and *stibium* for iron, tin, and antimony and gave zinc the "Latin" name *zincum*. The names *sodium* and *potassium* were changed to *natrium* and *kalium*. All metallic elements discovered after this date have been given names ending in *-ium* (or occasionally *-um*). Examples are *cadmium*, *lanthanum*, *lithium*, *thallium*, *radium*. The name *helium* is anomalous. This element, which was first detected in the sun, was assumed to be an alkali metal but when it was discovered terrestrially it was found to be an inert gas.

A number of new metals were first obtained in the form of their oxides. These incombustible, refractory substances were commonly called "earths". The names given to the earths conventionally ended in *-(i)a* (e.g. *strontia*, *yttria*); the names of the corresponding metals were then formed by replacing *-(i)a* by *-(i)um*. The suffix *-a* appears to have been suggested by the names *soda* and *magnesia*; *alumina* and *silica* (actually not a metallic oxide) were early names of this type which served as patterns for others.

No systematic form has been adopted for the names of non-metallic elements. Chaptal followed Lavoisier's example by inventing the name *nitrogen* but thereafter the suffix *-gen* was not used in forming the name of an element. (It has been used, however, in forming the names of certain organic compounds.) The names *fluorine*, *iodine* and *bromine*, based on Davy's original name *chlorine*, suggested another form but, other than in the name of the analogue *astatine*, the suffix *-ine* was not used again in

the name of an element. (It has been much used, however, in forming the names of compounds.) The name *carbon* suggested yet another possible suffix for the name of a non-metallic element. It served as the pattern for the names *boron* (1812) and *silicon* (1817) but the idea was not continued. The suffix appeared again about eighty years later in the names of the inert gases (e.g. argon, neon) but then it originated as the neuter ending of certain Greek adjectives.

In most cases the name proposed by the discoverer of an element has been accepted (*Beryllium*, *hydrogen*, *nitrogen* and *oxygen* are among the few names which differ from those originally proposed.) It is now generally agreed that the right to name an element should go to the first person to give definite proof of the existence of any isotope of the element (whether occurring naturally or produced artificially) and that if a claim of discovery is unacceptable or is refuted by later research any name which had been proposed should be withdrawn. (For this reason the early names given to some of the "missing" elements, e.g. *masurium* and *illinium* for elements 43 and 61 respectively, should no longer be used.) Names have been formed from a wide range of sources.

It has already been noted that seven metals were known in ancient times. It so happened that there were seven known celestial bodies—the sun, the moon and five major planets—which, it was thought, revolved round the Earth. For reasons which were more fanciful than logical, the seven metals were associated with the seven celestial bodies. The symbols given to metals were the symbols of these bodies (see p. xv). The use of the name *mercury* for both the planet and the element is a survival of this association. Many centuries later, when names were needed for newly discovered elements, chemists again turned to the skies though, with the exception of *helium*, no connection of any sort was implied. The four remaining planets provided the names *tellurium* (Earth), *uranium*, *neptunium*, *plutonium*. Two of the minor planets provided the names *cerium* and *palladium*.

The planets were named after the gods. This seems to have suggested another source of chemical names—the names of mythical deities. Among the elements named after gods and goddesses are *tantalum*, *niobium*, *thorium* and *vanadium*.

Place-names have provided a particularly fruitful source of names of elements. The chemical name may be derived from that of the town or country in which the element was discovered, of the native land of the discoverer, or of the place in which the original mineral was found. Among the many names of this type are *holmium* (Stockholm), *strontium* (from a parish in Scotland), *scandium* (Scandinavia), *francium*, *germanium*, *polonium* (Poland) and *europium*. The little town of Ytterby (near Stockholm) has the distinction of giving rise to the names of four

chemical elements: *yttrium*, *ytterbium*, *terbium*, *erbium*. (It was in a quarry at Ytterby that the mineral now called gadolinite, a source of "rare earth" elements, was discovered.)

Some elements have been named after people. *Gadolinium* was named after the Finnish chemist and mineralogist Gadolin who first investigated the mineral found at Ytterby. The names of a number of transuranic elements commemorate famous scientists; Curie, Mendeléeff and Einstein are among those who have been honoured in this way.

An interesting group of names comprises those which reflect something of the circumstances in which the elements were discovered. *Lanthanum* was found "lurking" with cerium and *dysprosium* was "hard to get at"; *krypton* was the "hidden" gas and *xenon* the "strange" gas. Both *cobalt* and *nickel* owe their names to the fact that they were found in ores which were regarded as false or evil.

It will be noted that the names quoted in the previous paragraphs do not give any indication of the nature of the elements themselves; the names are merely labels for the purpose of identification. There are some names, however, which were based on some property of the elements they denote. Thus *sodium* is the metallic element of the familiar soda; *boron* is the essential element of borax. *Hydrogen* is the water-producer, *oxygen* the acid-producer, and *nitrogen* the nitre-producer. *Argon*, which forms no chemical compounds, is the "idle" element. The names *chlorine* and *iodine* were formed from the Greek names for their colours and the name *bromine* is a reminder of the offensive smell of the element. *Chromium* and *iridium* were so named because they form brightly coloured compounds and the name *rhodium* reflects the rose-red colour of the salts which the element forms.

A few elements were discovered by their characteristic spectra and were named from the colours of the prominent spectral lines. *Caesium* (sky blue), *rubidium* (dark red) and *thallium* (green) are examples of such names.

Isotopes, being chemically identical, do not normally have distinctive chemical names. The two variant forms of hydrogen are known by the special names *deuterium* (second) and *tritium* (third). The modern practice, when referring to specific isotopes, is to quote the atomic weight. Thus natural uranium consists of over 99% of *uranium 238* (U238), which is the "normal" form, and a small proportion of the isotopes U235 and U234.

Chemical symbols

The alchemists delighted in every form of cryptic expression. They denoted their substances, both elementary and compound, by means of symbols. Some of their symbols are shown below. (Note that the symbols

for the seven early metals, as with the Greeks, are also those for the heavenly bodies.)

☉	Gold Sun	☾	Silver Moon	♀	Copper Venus
♃	Tin Jupiter	♄	Lead Saturn	♂	Iron Mars
♂	Antimony	☿	Mercury	⊖	Arsenic

Dalton, in line with the alchemists, represented elements and compounds by symbols but with one important difference. Whereas the alchemist's symbol represented the substance, i.e. an indefinite amount of it, Dalton's symbols represented either simple atoms or "compound atoms" (i.e. molecules). Some of his symbols are shown below. (Note that he did not know the true composition of some of the compounds.)

Simple atoms

☉	⊕	●	○	⊕	⊗
Hydrogen	Azote	Carbon	Oxygen	Sulphur	Phosphorus

Compound atoms

☉☉	☉☉	
Water	Ammonia	
☉☉☉	☉●☉	☉⊕☉
Nitrous oxide	Carbonic anhydride	Sulphuric acid

This pictorial representation of atoms and molecules considerably helped to make Dalton's theory better understood and accepted.

Although Dalton ingeniously devised a number of different symbols with a circular outline, it became necessary to represent some atoms, e.g. those of iron, lead and copper, by a circle enclosing the initial letter of the name. Berzelius simplified and improved the scheme by proposing that the symbols should be letters of the alphabet which could more easily be drawn and printed. He represented an atom by the initial letter or letters of what he considered to be the Latin name of the element. He proposed that a single letter should be used for the chief non-metallic element and that, when several names had the same initial letter, a second letter should be added. As examples he quoted:

S	Sulphur	C	Carbonicum (carbon)
Si	Silicium (silicon)	Co	Cobaltum (cobalt)
Sb	Stibium (antimony)	Cu	Cuprum (copper)
Sn	Stannum (tin)		

In 1819 he published a list of fifty elements with their corresponding symbols.

Berzelius represented compounds by adding together the symbols of the constituent elements. He commonly abbreviated the symbols by representing an oxygen atom or a sulphur atom by placing a dot or a dash above the symbols of the other element(s) in the compound. He used a symbol with a horizontal bar through it to represent what he called a "double atom", e.g. the "double" hydrogen atom in a molecule of water. Because of these and other complications, his contemporaries were slow to accept his system. Gradually, however, it gained acceptance, especially when some of its peculiarities were removed, and eventually gave rise to the system in use today.

The rise of inorganic chemistry

Chemistry before 1500, other than in the fields of pharmacy and metallurgy, was indistinguishable from alchemy. Paracelsus, by his interest in medicine, helped to turn the minds of the alchemists from the making of gold to more practicable ends, though he made no great discoveries himself. Some of his successors, notably Libavius, Van Helmont and Glauber, discovered a number of new chemical substances, but the secrecy and mysticism associated with alchemy still clung to the chemical work of this period. Francis Bacon (1561–1626) helped to dispel this unscientific atmosphere but, as already noted, Robert Boyle must be regarded as the true founder of the science of chemistry.

The main contributions of the 18th century were the discoveries of the nature of air (and certain common gases), of the composition of water, and of the mechanism of combustion. Black investigated the nature of the alkalis; Cavendish studied hydrogen and water; Priestley, best known for the discovery of oxygen, perfected methods for collecting and manipulating gases; Lavoisier interpreted combustion as a combination with oxygen. Towards the end of the century the number of known compounds was considerably extended, notably by the Swedish apothecary Scheele, and the progress continued in the following century. By about 1820 all the commoner inorganic gases had been prepared and analysed and the composition of the main mineral acids established. The principal alkali metals had been extracted from their compounds and about fifty elements identified. The basic laws of chemical combination had been tested by experiment and the atomic theory enunciated.

The period from about 1760 to 1820 was one of the most fertile in the history of chemistry. Within this space of sixty years the foundations of inorganic chemistry were laid. And it was within the latter half of this period that the nomenclature of inorganic compounds was established on a rational basis.

The naming of inorganic compounds

Until near the end of the 18th century the names in use for the chemical substances were little more than arbitrary labels. A few which had been devised during that century, e.g. *fixed air*, *nitrous air*, revealed something of the qualities of the substances they denoted, but the large majority of the names then in use gave no indication of chemical nature or properties. They had grown up almost haphazardly over the centuries in which little or nothing was known of chemical composition. Some of the names dated from classical antiquity; many (e.g. *crocus martis*, *vitriol of Venus**) were relics of the age of alchemy. A few substances were known by the name of the discoverer, e.g. *fuming liquor of Libavius* (stannic chloride), or of the place of discovery, e.g. *Epsom salt*.

A curious practice had also developed of naming chemical compounds from their superficial but quite irrelevant resemblances to familiar substances, especially to those known in the kitchen. Thus antimony trichloride, because of its appearance, was known as *butter of antimony*; the term *oil* was used for almost any viscous liquid, including that obtained from vitriol as well as that obtained from olives; *spirits of salt* and *spirits of hartshorn*, being extracted by distillation, were named as if they were comparable with spirits of wine. Among the other "kitchen" names were *cream of tartar*, *liver of sulphur* and *sugar of lead*.

The continued use of unsystematic and often misleading names could only lead to eventual confusion. It was vital to the progress of chemistry that the naming of compounds should be systematic. T. O. Bergman (1735–1784) drew attention to this need and, in particular, suggested that each acid should be given a distinctive name, which name should be reflected in those of its salts.

Independently, Guyton de Morveau began to plan a new system of chemical nomenclature. The essence of the system, which was developed in collaboration with the other French chemists Lavoisier, Berthollet and Fourcroy, was that the name given to a substance should indicate its chemical nature and composition, i.e. to which class of substance it belongs and which elements it contains. The proposals were put before the Académie des Sciences in Paris in 1787.

Lavoisier presented the first memoir. He explained the need for an accurate and appropriate language in the development of science and set out the principles of the new proposals. He admitted that he could not accomplish his aim of devising a logical system of nomenclature "without doing frequent injury to established custom and adopting denominations which at first appear harsh and barbarous". But, he suggested, the ear

* *Crocus martis* = saffron of Mars (iron) = ferric oxide; *vitriol of Venus* = sulphate of copper.

would soon become used to the new terms, especially as they fitted in with a rational system, and would be found to be no more harsh or extraordinary than many then in use. He ridiculed such names as *butter of antimony* and *flowers of zinc* on the grounds that they gave rise to false ideas. In the second memoir of the series de Morveau set out the details of the proposals.

As the number of substances composed of two simple substances (i.e. elements) was so large, it was necessary, it was said, to classify these substances and to devise names which were indicative of the classes. One of these classes, an important one, comprised the mineral acids which, at that time, were regarded as compounds of oxygen (the acidifying principle) and a non-metallic element. Each acid was to be given a distinctive name which would indicate the non-metallic element from which it was derived. Hence the acid produced by the combination of sulphur and oxygen was to be renamed *sulphuric acid* (formerly *oil of vitriol*). Similarly, the acids derived from carbon and from phosphorus were to be known as *carbonic acid* and *phosphoric acid* respectively. When two different acids could be formed from the same element, e.g. sulphur, the name of the acid containing the higher proportion of oxygen was to carry the suffix *-ic* (Fr. *-ique*), e.g. *sulphuric*, and that of the acid containing the lower proportion of oxygen the suffix *-ous* (Fr. *-eux*), e.g. *sulphurous*.

The second important class of substances composed of two elements comprised the calces of the metals. Each calx contained a common principle (oxygen) and a particular principle (the metal). The name, it was maintained, should indicate both the class and the particular member of the class. The name *oxide* was proposed for the class; it was formed from *oxygène* on the analogy of the name *acide* of the other great class. The name of a particular oxide was to include the name of the metal, e.g. a compound of zinc and oxygen was to be known as *oxide of zinc* or *zinc oxide*.

Turning to substances composed of three (or more) elements, special attention was given to the naming of salts. The name, it was said, should indicate that the substance belongs to the class of salts; further, it should indicate the acid from which the salt is derived and also the metallic base which determined the particular member. The name of any salt of an acid was to be formed directly from the name of the acid. The termination *-ate* was proposed for the names of salts derived from acids with names ending in *-ic* (e.g. a salt of sulphuric acid was to be known as a *sulphate*) and the termination *-ite* for the names of salts derived from acids with names ending in *-ous* (e.g. a salt of sulphurous acid was to be known as a *sulphite*).* A particular salt would be distinguished by the addition of

* For the origins of the suffixes *-ate* and *-ite* the glossary should be consulted.

the name of the metal or base, e.g. *sulphate of copper* or *copper sulphate*. It is interesting to note that some bases, e.g. soda, lime, had not been decomposed at that time and so it was necessary to use such names as *sulphate of soda* and *carbonate of lime*. Such names, now obsolete in chemistry, are still to be found in commercial and popular use.

The memoirs were published in Paris in 1787 under the title *Méthode de Nomenclature Chimique*; an English translation was published in London in the following year. At first the proposals received general but not ready acceptance; gradually, however, the simplicity and logicity of the system led to its universal adoption.

Lavoisier had aimed to make the system capable of extension so that future requirements could be met. The suffixes *-ic* and *-ous* were clearly suitable for the names of any new acids which might be discovered and the suffixes *-ate* and *-ite* for the names of their salts. Later the suffixes *-ic* and *-ous* were used to indicate different degrees of oxidation and hence of chemical valency. It is strange that the French chemists did not recognize the possibilities of the suffix *-ide* (as in *oxide*) in forming the names of other kinds of binary compounds. Instead they proposed the French suffix *-ure* which was latinized as *-uretum* and gave rise to *-uret* in English. Thus a compound of an element with carbon, for example, was known for a time as a *carburet*. But the pattern set by *oxide* was too convenient to remain overlooked for long. Gradually such terms as *carbide* and *chloride* appeared and (outside France) eventually displaced the terms ending in *-ure* or *-uret*.

Meanwhile Dr. T. Thomson of England (in his *System of Chemistry*, 1804) had made an important contribution to chemical nomenclature by the introduction of prefixes. He devised the term *protoxide* for a "first" oxide (Gk. *prōtos*, first), e.g. protoxide of lead PbO , and the term *peroxide* for a higher oxide in which the metal is "thoroughly" oxidized (L. *per*, all through, thoroughly), e.g. peroxide of lead PbO_2 . It was a simple step to use the prefixes in forming the names of compounds derived from the oxides, e.g. *protochloride*, *perchloride*. An interesting extension of the use of *per-* is seen in the names of certain acids, e.g. *perchloric* acid. When used with the name of an acid ending in *-ic* it denotes a "higher" acid, i.e. one containing a greater (or the greatest) proportion of oxygen. This use of *per-* led to the use of the contrasting prefix *hypo-* (Gk., under) which, when affixed to the name of an acid ending in *-ous*, indicates a lower (or the lowest) proportion of oxygen.* Thomson's original prefixes *proto-* and *per-* have now largely been replaced by others (e.g. *mono-*, *di-*) with definite numerical meanings.

* The prefix *per-*, with its original meaning of "all through", has been reintroduced in forming the names of certain organic compounds, e.g. *perchloroethane* $\text{CCl}_3\cdot\text{CCl}_3$ in which all the hydrogen atoms of ethane are replaced by chlorine atoms.