

精细化工专业英语

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前言

随着现代科学技术的进步和发展，世界精细化学工业也发生了巨大的变化，有关精细化学工业的书籍与杂志层出不穷，而绝大多数的化学、精细化工的文献是用英语写成的。因此，精细化工专业英语既是传播信息的媒介，又是通向精细化工世界的桥梁和不可缺少的有力工具。通过精细化工英语的学习将有助于学生对专业知识的进一步了解，熟悉专业文章的英文表达。

本书课文材料共 30 篇，分 5 个部分，均选自原版英文教科书、科技报告、专著及专业期刊（大部分为国外 20 世纪 90 年代以来的出版物）。其中第一部分 1~6 单元着重介绍无机和有机化合物的命名、性质；第二部分 7~12 单元对有机化合物波谱性质做了简介，包括紫外-可见光谱、红外光谱、核磁共振、质谱等；第三部分 13~18 单元为有机化学实验内容，涉及重结晶、蒸馏、分离、合成等；第四部分 19~24 单元对精细化工常见的种类进行了介绍，内容涉及药物中间体、香料、化妆品、染料、农药等；第五部分 25~30 单元介绍精细化学品的最新进展和应用。为便于学生自学，本书每课配有单词和词组表，并作了必要的注释。

本书内容既注重对专业知识面的覆盖，又照顾专业的历史发展资料，并反映当前最新发展状况和若干重要科技领域（如能源、环保等），可供高校精细化工、应用化学及相关专业的学生作为教材或教学参考书，也可供从事该领域科技人员参考。

本书由华东理工大学花建丽、陈锋、孟凡顺主编，华东理工大学李晶、许兆武、马学美、瞿祎等参加了编写工作。全书由花建丽统稿，陈锋、孟凡顺负责练习和注释的编写。本教材在成书过程中得到了化学工业出版社和华东理工大学教务处大力支持，在此向他们表示衷心的感谢。

由于编者水平有限，加之是第一次编写精细化工类专业英语教材，疏漏和不妥之处在所难免，恳请读者批评指正。

编 者

2007 年 3 月

PART 1

INTRODUCTION OF GENERAL CHEMICALS

Unit 1

The Elements and the Periodic Table

The number of protons in the nucleus of an atom is referred to as the atomic number, or proton number, Z . The number of electrons in an electrically neutral atom is also equal to the atomic number, Z . The total mass of an atom is determined very nearly by the total number of protons and neutrons in its nucleus. This total is called the mass number, A . The number of neutrons in an atom, the neutron number, is given by the quantity $A-Z$.

The term element refers to a pure substance with atoms all of a single kind. To the chemist the “kind” of atom is specified by its atomic number, since this is the property that determines its chemical element behavior. At present all the atoms from $Z=1$ to $Z=107$ are known; there are 107 chemical elements. Each chemical element has been given a name and distinctive symbol. For most elements the symbol is simply the abbreviated form of the English name consisting of one or two letters, for example:

oxygen = O nitrogen = N neon = Ne lead = Pb (plumbum)

A complete listing of the elements may be found in Table 1-1.

Beginning in the late seventeenth century with the work of Robert Boyle, who proposed the presently accepted concept of an element, numerous investigations produced a considerable knowledge of the properties of elements and their compounds. In 1869, D. Mendeleev and L. Meyer, working independently, proposed the periodic law. In modern form, the law states that the properties of the elements are periodic functions of their atomic numbers. In other words, when the elements are listed in order of increasing atomic number, elements having closely similar properties will fall at definite intervals along the list. Thus it is possible to arrange the list of elements in tabular form with elements having similar properties placed in vertical columns. Such an arrangement is called a periodic table.

Table 1-1 IUPAC names and symbols of the elements

Name		Symbol	At. No.	中文名
Actinium	[æk'tɪniəm]	Ac	89	锕
Aluminum	[ə'lju:miənəm]	Al	13	铝
Americium	[.æmə'risjəm]	Am	95	镅
Antimony	[.æntiməni]	Sb	51	锑
Argon	[.ɑ:gɒn]	Ar	18	氩
Arsenic	[.ɑ:sənik]	As	33	砷
Astatine	[.æstəti:n]	At	85	砹
Barium	[.bɛəriəm]	Ba	56	钡
Berkelium	[.bɛ:kliəm]	Bk	97	锫
Beryllium	[bɛ'ri:ljəm]	Be	4	铍
Bismuth	[.bizməθ]	Bi	83	铋
Boron	[.bɔ:rən]	B	5	硼
Bromine	[.brəumi:n]	Br	35	溴
Cadmium	[.kædmiəm]	Cd	48	镉
Calcium	[.kælsiəm]	Ca	20	钙
Californium	[kæli'fɔ:niəm]	Cf	98	锎
Carbon	[.kɑ:bən]	C	6	碳
Cerium	[.siəriəm]	Ce	58	铈
Cesium	[.si:zjəm]	Cs	55	铯
Chlorine	[.klɔ:ri:n]	Cl	17	氯
Chromium	[.krəumjəm]	Cr	24	铬
Cobalt	[kə'bo:lt]	Co	27	钴
Copper	[.kɒpə]	Cu	29	铜
Curium	[.kjuəriəm]	Cm	96	锔
Dysprosium	[dis'prəusiəm]	Dy	66	镝
Einsteinium	[aɪn'steɪniəm]	Es	99	锿
Erbium	[.ə:biəm]	Er	68	铒
Europium	[juə'rəupiəm]	Eu	63	铕
Fermium	[.fɜ:miəm]	Fm	100	镆
Fluorine	[.fluəri:n]	F	9	氟
Francium	[.frænsiəm]	Fr	87	钫
Gadolinium	[.gædə'liniə:m]	Gd	64	钆
Gallium	[.gæliəm]	Ga	31	镓
Germanium	[dʒə:'meiniəm]	Ge	32	锗
Aurum	[.ɔ:rəm]	Au	79	金
Hafnium	[.hæfniəm]	Hf	72	铪
Helium	[.hi:ljəm]	He	2	氦
Holmium	[.hɒlmiəm]	Ho	67	钬
Hydrogen	[.haɪdrədʒən]	H	1	氢
Indium	[.indiəm]	In	49	铟
Iodine	[.aɪədi:n]	I	53	碘

续表

Name		Symbol	At. No.	中文名
Iridium	[i'ridiəm]	Ir	77	铱
Iron	[aɪən]	Fe	26	铁
Krypton	[kriptɒn]	Kr	36	氪
Lanthanum	[lænθənəm]	La	57	镧
Lawrencium	[lɔ:'rensiəm]	Lr	103	铹
Lead	[li:d]	Pb	82	铅
Lithium	[liθiəm]	Li	3	锂
Lutetium	[lu:'ti:ʃiəm]	Lu	71	镥
Magnesium	[mæg'ni:zjəm]	Mg	12	镁
Manganese	[mæŋgəni:z]	Mn	25	锰
Mendelevium	[,mendə'li:viəm]	Md	101	钔
Mercury	[mə:kjuri]	Hg	80	汞
Molybdenum	[mə'libdinəm]	Mo	42	钼
Neodymium	[ni(:)ə'dimiəm]	Nd	60	钕
Neon	[ni:ən]	Ne	10	氖
Neptunium	[nep'tju:niəm]	Np	93	镎
Nickle	[nikl]	Ni	28	镍
Niobium	[nai'əubiəm]	Nb	41	铌
Nitrogen	[naitrədʒən]	N	7	氮
Nobelium	[nəu'beliəm]	No	102	锗
Osmium	[ɔzmiəm]	Os	76	锇
Oxygen	[ɔksidʒən]	O	8	氧
Palladium	[pə'leidiəm]	Pd	46	钯
Phosphorus	[fɔsfərəs]	P	15	磷
Platinum	[plætiniəm]	Pt	78	铂
Plutonium	[plu:'təuniəm]	Pu	94	钚
Polonium	[pə'ləuniəm]	Po	84	钋
Potassium	[pə'tæsɪəm]	K	19	钾
Praseodymium	[,preiziəu'dimiəm]	Pr	59	镨
Promethium	[prə'mi:θiəm]	Pm	61	钷
Protactinium	[,prəutæk'tiniəm]	Pa	91	镤
Radium	[reɪdʒəm]	Ra	88	镭
Radon	[reɪdɒn]	Rn	86	氡
Rhenium	[ri:niəm]	Re	75	铼
Rhodium	[rəudiəm]	Rh	45	铑
Rubidium	[ru:'biðiəm]	Rb	37	铷
Ruthenium	[ru:'θi:niəm]	Ru	44	钌
Samarium	[sə'mæəriəm]	Sm	62	钐
Scandium	[kændiəm]	Sc	21	钪
Selenium	[si'li:niəm]	Se	34	硒
Silicon	[silikən]	Si	14	硅
Silver	[silvə]	Ag	47	银
Sodium	[səudʒəm]	Na	11	钠
Strontium	[strɒnʃiəm]	Sr	38	锶
Sulfur	[sʌlfə]	S	16	硫

续表

Name		Symbol	At. No.	中文名
Tantalum	['tæntələm]	Ta	73	钽
Technetium	[tek'ni:ʃiəm]	Tc	43	锝
Tellurium	[te'ljuəriəm]	Te	52	碲
Terbium	['tə:biəm]	Tb	65	铽
Thallium	['θæliəm]	Tl	81	铊
Thorium	['θɔ:riəm]	Th	90	钍
Thulium	['θju:liəm]	Tm	69	铥
Tin	[tin]	Sn	50	锡
Titanium	[tai'teinjəm]	Ti	22	钛
Tungsten	['tʌŋstən]	W	74	钨
Uranium	[juə'reiniəm]	U	92	铀
Vanadium	[və'neidiəm]	V	23	钒
Xenon	['zenɒn]	Xe	54	氙
Ytterbium	[i'tə:biəm]	Yb	70	镱
Yttrium	['itriəm]	Y	39	钇
Zinc	[ziŋk]	Zn	30	锌
Zirconium	[zə:'kəʊniəm]	Zr	40	锆

IUPAC 是 International Union of Pure and Applied Chemistry, 即“国际纯粹化学和应用化学联合会”的缩写。

Each horizontal row of elements constitutes a period. It should be noted that the lengths of the periods vary. There is a very short period containing only 2 elements, followed by two short periods of 8 elements each, and then two long periods of 18 elements each. The next period includes 32 elements, and the last period is apparently incomplete. With this arrangement, elements in the same vertical column have similar characteristics. These columns constitute the chemical families or groups. The groups headed by the members of the two 8-elements are designated as main group elements, and the members of the other groups are called transition or inner transition elements.

In the periodic table, a heavy stepped line divide the elements into metals and nonmetals. Elements to the left of the this line (with the exception of hydrogen) are metals, while those to the right are nonmetals. This division is for convenience only: elements bordering the line—the metalloids—have properties characteristic of both metals and nonmetals. It may be seen that most of the elements, including all the transition and inner transition elements, are metals.

Except for hydrogen, a gas, the elements of group A make up the alkali metal family. They are very reactive metals, and they are never found on the elemental state in nature. However, their compounds are widespread. All the members of the alkali metal family form ions having a charge of 1+ only. In contrast, the elements of group

B—copper, silver, and gold—are comparatively inert. They are similar to the alkali metals in that they exist as 1+ ions in many of their compounds. However, as is characteristic of most transition elements, they form ions having other charges as well.

The elements of group A are known as the alkaline earth metals. Their characteristic ionic charge is 2+. These metals, particularly the last two members of the group, are almost as reactive as the alkali metals. The group B elements—zinc, cadmium, and mercury—are less reactive than are those of group A, but they are more reactive than the neighboring elements of group B. The characteristic charge on their ions is also 2+.

With the exception of boron, group A elements are also fairly reactive metals. Aluminum appears to be inert toward reaction with air, but this behavior stems from the fact that the metal forms a thin, invisible film of aluminum oxide on the surface, which protects the bulk of the metal from further oxidation. The metals of group A form ions of 3+ charge. Group B consists of the metals scandium, yttrium, lanthanum, and actinium.

Group A consists of a nonmetal, carbon, two metalloids, silicon and germanium, and two metals, tin and lead. Each of these elements forms some compounds with formulas which indicate that four other atoms are present per group A atom, as, for example, carbon tetrachloride, CCl_4 . The group B metals—titanium, zirconium, and hafnium—also form compounds in which each group B atom is combined with four other atoms; these compounds are nonelectrolytes when pure.

The elements of group A include three nonmetals—nitrogen, phosphorus, and arsenic—and two metals—antimony and bismuth. Although compounds with the formulas N_2O_5 , PCl_5 , and AsCl_5 exist, none of them is ionic. These elements do form compounds—nitrides, phosphides, and arsenides—in which ions having charges of minus three occur. The elements of group B are all metals. These elements form such a variety of different compounds that their characteristics are not easily generalized.

With the exception of polonium, the elements of group A are typical nonmetals. They are sometimes known as the chalcogens, from the Greek word meaning “ash former”. In their binary compound with metals they exist as ions having a charge of 2-. The elements of group A are all nonmetals and are known as the halogen, from the Greek term meaning “salt formers.” They are the most reactive nonmetals and are capable of reacting with practically all the metals and with most nonmetals, including each other.

The elements of groups B, B are all metals. They form such a wide variety of compounds that it is not practical at this point to present any examples as being typical of the behavior of the respective groups .

The periodicity of chemical behavior is illustrated by the fact that excluding the first period, each period begins with a very reactive metals. Successive elements along the period show decreasing metallic character, eventually becoming nonmetals, and finally, in group A, a very reactive nonmetals is found. Each period ends with a member of the noble gas family.

(Selected from *Inorganic chemistry*, by T. W. Swaddle, 1997)

New Words and Expressions

function [ə'fʌŋkʃən] n. 官能, 函数
transition [træn'ziʃən] n. 转变, 过渡
metalloid ['metəloid] n. 准金属
alkaline earth metal 碱土金属
non-electrolyte ['nɒn-ɪ'lektroʊlaɪt] n. 非电解质
nitride ['naɪtraɪd] n. 氮化物

phosphide ['fɒsfaid] *n.* 磷化物
arsenide ['ɑ:sənaid] *n.* 砷化物
chalcogen ['kælkədʒən] *n.* 硫族元素
main group element 主族元素

Notes

Beginning in the late seventeenth century with the work of Robert Boyle, who proposed the presently accepted concept of an element, numerous investigations produced a considerable knowledge of the properties of elements and their compounds.

参考译文：早在 17 世纪末期，罗伯特·波义尔就开始了这项工作，他提出了现在公认的元素概念，大量的研究使我们对元素及其化合物的性质有了相当的了解。

Thus it is possible to arrange the list of elements in tabular form with elements having similar properties placed in vertical columns.

参考译文：于是，将具有类似性质的元素排成纵列，从而把元素排成表格形式是可能的。

each：在此处作副词，一般在句子末尾，意思是“每个”，“各（个地）”，也用作形容词和代词，如“each horizontal row”和“each of these elements”。

They form such a wide variety of compounds that it is not practical at this point to present any examples as being typical of the behavior of the respective groups.

参考译文：它们形成了如此众多的化合物种类，因此，我们甚至无法举出任何能表现各组元素典型变化的例子。

Exercises

1. Answer the following questions:

- (1) What is the periodic law?
- (2) How is the periodic table organized?
- (3) What is the relation among the proton number Z , the neutron number and the mass number?
- (4) Please write out the elements in Group A and point out which one is nonmetal, metalloid and metal.

2. Put the following into Chinese:

main group element	transition element	periodic table
alkali metal	reactive metal	

3. Put the following into English:

原子 质子 电子 中子 离子

4. Translation:

The term element refers to a pure substance with atoms all of a single kind. To the chemist the “kind” of atom is specified by its atomic number, since this is the property that determines its chemical element behavior.

Unit 2

The Nomenclature of Inorganic Compounds

With the discovery of thousands of new inorganic compounds it has become necessary to revise the traditional rules of nomenclature. An international committee has recommended a set of rules for naming compounds, and these are now being adopted throughout the world. Many of the older names are still used, however, and our ensuing discussion will include in many cases both the old and new, with emphasis on the latter. One of the principal changes is that proposed by Albert Stock and now known as Stock system for the naming of compounds of metals (oxides, hydroxides, and salts) in which the metal may exhibit more than one oxidation state. In these cases the oxidation state of the metal is shown by a Roman numeral in parentheses immediately following the English name of the metal which corresponds to its oxidation number. If the metal has only one common oxidation number, no Roman numeral is used. Another important change is in the naming of complex ions and coordination compounds. We will defer the nomenclature of the latter until these compounds are discussed.

1. Naming Metal Oxides, Bases, and Salts

The students should have a good start in learning nomenclature if he has learned the Valence Table 2-1 which gives both charges on ions and names for the more common ones. A compound is a combination of the compounds from names of the ions, for example, NaCl, is sodium chloride; Al(OH)₃ is aluminum hydroxide; FeBr₂ is iron () bromide or ferrous bromide; Ca(C₂H₃O₂)₂ is calcium acetate; Cr₂(SO₄)₃ is chromium () sulfate or chromic sulfate, and so on. Table 2-2 gives some additional examples of the naming metal compounds. Of the two common system used, the Stock system is preferred. Note that even in this system, however, the naming of the negative ion will need to be obtained from Valence Table 2-2.

Table 2-1 Some common ions

1 ⁺	2 ⁺	2 ⁺	3 ⁺
ammonium NH ₄ ⁺	barium Ba ²⁺	magnesium Mg ²⁺	aluminum Al ³⁺
copper() Cu ⁺	calcium Ca ²⁺	manganese () Mn ²⁺	chromium() Cr ³⁺
hydrogen H ⁺	chromium () Cr ²⁺	mercury () Hg ²⁺	iron() Fe ³⁺
potassium K ⁺	copper () Cu ²⁺	mercury () Hg ₂ ²⁺	
silver Ag ⁺	iron () Fe ²⁺	tin () Sn ²⁺	
sodium Na ⁺	lead () Pb ²⁺	strontium Sr ²⁺	
		zinc Zn ²⁺	

续表

3 ⁻		2 ⁻		1 ⁻		1 ⁻	
Arsenate	AsO ₄ ³⁻	carbonate	CO ₃ ²⁻	acetate	C ₂ H ₃ O ₂ ⁻	hydrogen sulfite	HSO ₃ ⁻
Arsenite	AsO ₃ ³⁻	chromate	Cr ₂ O ₇ ²⁻	bromide	Br ⁻	hydride	H ⁻
phosphate	PO ₄ ³⁻	dichromate	CrO ₄ ²⁻	chlorate	ClO ₃ ⁻	hydroxide	OH ⁻
phosphite	PO ₃ ³⁻	oxalate	C ₂ O ₄ ²⁻	chloride	Cl ⁻	hypochlorite	ClO ⁻
		oxide	O ²⁻	chlorite	ClO ₂ ⁻	iodate	IO ₃ ⁻
		sulfide	S ²⁻	cyanide	CN ⁻	nitrate	NO ₃ ⁻
		sulfate	SO ₄ ²⁻	fluoride	F ⁻	nitrite	NO ₂ ⁻
		sulfite	SO ₃ ²⁻	hydrogen		perchlorate	ClO ₄ ⁻
				carbonate	HCO ₃ ⁻	permanganate	MnO ₄ ⁻
				(bicarbonate)			
				hydrogen	HSO ₄ ⁻		
				sulfate			

Table 2-2 Names of some metal oxides, bases and salts

FeO	iron() oxide	ferrous oxide
Fe ₂ O ₃	iron() oxide	ferric oxide
Sn(OH) ₂	tin() hydroxide	stannous hydroxide
Sn(OH) ₄	tin() hydroxide	stannic hydroxide
Hg ₂ SO ₄	mercury() sulfate	mercurous sulfate
HgSO ₄	mercury() sulfate	mercuric sulfate
NaClO	sodium hypochlorite	sodium hypochlorite
K ₂ Cr ₂ O ₇	potassium dichromate	potassium dichromate
Cu ₂ (AsO ₄) ₃	copper() arsenate	cupric arsenate
Cr(C ₂ H ₃ O ₂) ₃	chromium() acetate	chromic acetate

Negative ions, anions, may be monatomic or polyatomic. All monatomic anions have names ending with ide. Two polyatomic anions which also have names ending with ide are the hydroxide ion, OH⁻, and the cyanide ion, CN⁻.

Many polyatomic anions contain oxygen in addition to another element. The number of oxygen atoms in such oxyanions is denoted by the use of the suffixes ite and ate, meaning fewer and more oxygen atoms, respectively. In cases where it is necessary to denote more than two oxyanions of the same element, the prefixes hypo and per, meaning still fewer and still more oxygen atoms, respectively, may be used. A series of oxyanions is named in Table 2-3.

Table 2-3 Names of oxyanions

Fewest Oxygen Atoms hypo-ite		Fewer Oxygen Atoms -ite		More Oxygen Atoms -ate		Most Oxygen Atoms per-ate	
ClO ⁻	hypochlorite	ClO ₂ ⁻	chlorite	ClO ₃ ⁻	chlorate	ClO ₄ ⁻	perchlorate
BrO ⁻	hypobromite	BrO ₂ ⁻	bromite	BrO ₃ ⁻	bromate	BrO ₄ ⁻	perbromate
IO ⁻	hypoiodite	IO ₂ ⁻	iodite	IO ₃ ⁻	iodate	IO ₄ ⁻	periodate
PO ₂ ⁻	hypophosphite	PO ₃ ³⁻	phosphite	PO ₄ ³⁻	phosphate		
		NO ₂ ⁻	nitrite	NO ₃ ⁻	nitrate		
		SO ₃ ²⁻	sulfite	SO ₄ ²⁻	sulfate		
				CO ₃ ²⁻	carbonate		

2. Naming Nonmetal Oxides

The older system of naming and one still widely used employs Greek prefixes for both the number of oxygen atoms and that of the other element in the compounds. The prefixes used are (1) mono-, sometimes reduced to mon-, (2) di-, (3) tri-, (4) tetra-, (5) penta-, (6) hexa-, (7) hepta-, (8) octa-, (9) nona- and (10) deca-. Generally the letter a is omitted from the prefix (from tetra on) when naming a nonmetal oxide and often mono- is omitted from the name altogether.

The Stock system is also used with nonmetal oxides. Here the Roman numeral refers to the oxidation state of the element other than oxygen.

In either system, the element other than oxygen is named first, the full name being used followed by oxide. Table 2-4 shows some examples.

Table 2-4 Names of some nonmetal oxides

Formula	Name	
CO	carbon() oxide	carbon monoxide
CO ₂	carbon() oxide	carbon dioxide
SO ₃	sulfur()	sulfur trioxide
N ₂ O ₃	nitrogen() oxide	dinitrogen trioxide
P ₂ O ₅	phosphorus() oxide	diphosphorus pentoxide
Cl ₂ O ₇	chlorine() oxide	dichlorine heptoxide

3. Naming Acids

Acid names may be obtained directly from knowledge of Valence Table 2-1 by changing the name of acid ion (negative ion) in the table as follows:

Ion in Table 2-1	Corresponding Acid
_____ate	_____ic
_____ite	_____ous
_____ide	hydro_____ic

Table 2-5 shows examples of the relationship.

There are few cases where name of the acid is changed slightly from that of the acid radical; for example H₂SO₄, is sulfuric acid rather than sulfic. Similarly, H₃PO₄, is phosphoric acid rather than phosphic.

Table 2-5 Names of some acids

Formula of Acid	Acid Ion in Table 2-3	Name of Acid
HC ₂ H ₃ O ₂	C ₂ H ₃ O ₂ ⁻ , acetate	acetic acid
H ₂ CO ₃	CO ₃ ²⁻ , carbonate	carbonic acid
HClO ₂	ClO ₂ ⁻ , chlorite	chlorous acid
HClO ₄	ClO ₄ ⁻ , perchlorate	perchloric acid
HCN	CN ⁻ , cyanide	hydrocyanic acid
HBr	Br ⁻ , bromide	hydrobromic acid
H ₄ SiO ₄	SiO ₄ ⁴⁻ , silicate	silicic acid
H ₃ AsO ₄	AsO ₄ ³⁻ , arsenate	arsenic acid
HMnO ₄	MnO ₄ ⁻ , permanganate	permanganic acid

The less common negative ions are not included in the Valence Table 2-1. For

example, BO_3^{3-} is the borate ion and H_3BO_3 is boric acid; TeO_4^{2-} is the tellurate ion and H_2TeO_4 is telluric acid, and so on.

4. Acid and Basic Salts

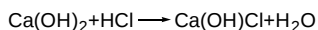
It is conceivable that in the neutralization of an acid by a base, only a part of the hydrogen might be neutralized; thus



The compound NaHSO_4 has acid properties, since it contains hydrogen, and is also a salt, since it contains both a metal and an acid radical. Such a salt containing acidic hydrogen is termed an acid salt. Phosphoric acid (H_3PO_4) might be progressively neutralized to form the salts, NaH_2PO_4 , Na_2HPO_4 , and Na_3PO_4 . The first two are acid salts, since they contain replaceable hydrogen. A way of naming these salts is to call Na_2HPO_4 disodium hydrogen phosphate and NaH_2PO_4 sodium dihydrogen phosphate. These acid phosphates are important in controlling the alkalinity of the blood. The third compound, sodium phosphate Na_3PO_4 , which contains no replaceable hydrogen, is often referred to as normal sodium phosphate, or trisodium phosphate to differentiate it from the two acid salts.

Historically, the prefix bi- has been used in naming some acid salts: industry, for example, Na_2CO_3 is called sodium bicarbonate and $\text{Ca}(\text{HSO}_3)_2$ calcium bisulfite. Since the bi- is somewhat misleading, the system of naming discussed above is preferable.

If the hydroxyl radicals of a base are progressively neutralized by an acid, basic salts may be formed:



Basic salts have properties of a base and will react with acids to form a normal salt and water.

The OH group in a basic salt is called an hydroxy group. The name of $\text{Bi}(\text{OH})_2\text{NO}_3$ would be bismuth dihydroxynitrate.

5. Mixed Salts

If the hydrogen atoms in an acid are replaced by two or more different metals, a mixed salt results. Thus the two hydrogen atoms in H_2SO_4 may be replaced with sodium and potassium to yield the mixed salt NaKSO_4 , sodium potassium sulfate, $\text{NaNH}_4\text{HPO}_4$ is a mixed acid salt that may be crystallized from urine.

(Selected from *Special English for Chemistry*, by **Y. X. Ma**, Lanzhou University Press, 2005)

New Words and Expressions

nomenclature [nəu'menkletʃə] *n.* 命名法, 术语

iron() bromide ['aɪən 'brəʊmaɪd] *n.* 溴化亚铁

ferrous ['fɛrəs] *adj.* 铁的, 含铁的, 亚铁的 ~ bromide 溴化亚铁

calcium acetate ['kælsiəm 'æsi:teit] *n.* 醋酸钙
 chromium() sulfate ['krəʊmjəm 'sʌlfeɪt] *n.* 硫酸铬
 chromic ['krəʊmɪk] *adj.* 含三价的铬的, 铬的
 arsenate ['ɑ:sɪnɪt] *n.* 砷酸盐, 砷酸盐
 arsenite ['ɑ:sɪnɪt] *n.* 亚砷酸盐
 phosphite ['fɒsfəɪt] *n.* 亚磷酸盐
 chromate ['krəʊmeɪt] *n.* 铬酸盐
 oxalate ['ɒksəleɪt] *n.* 草酸盐
 dichromate [daɪ'krəʊmeɪt] *n.* 重铬酸盐
 sulfite ['sʌlfəɪt] = sulphite *n.* 亚硫酸盐
 chlorate ['klɔ:reɪt] *n.* 氯酸盐
 chlorite ['klɔ:raɪt] *n.* 亚氯酸盐
 cyanide ['saɪənaɪd] *n.* 氰化物
 hydrogen carbonate 酸式碳酸盐
 bicarbonate [baɪ'kɑ:bənɪt] 酸式碳酸盐
 hydrogen sulfate ['haɪdrədʒən 'sʌlfəɪt] 酸式硫酸盐
 bisulfate [baɪ'sʌlfəɪt] 酸式硫酸盐
 hydrogen sulfite 酸式亚硫酸盐
 hydride ['haɪdraɪd] *n.* 氢化物
 hypochlorite [haɪpəu'klɔ:raɪt] *n.* 次氯酸盐
 iodate ['aɪədeɪt] *n.* 碘酸盐
 nitrite ['naɪtraɪt] *n.* 亚硝酸盐 (酯)
 perchlorate [pə'klɔ:reɪt] *n.* 高氯酸盐
 ferric ['fɛrɪk] *adj.* 铁的, 含铁的; [化] (正) 铁的, 三价铁的
 stannous ['stænəs] *adj.* 亚锡的, 二价锡的
 stannic ['stænik] *adj.* 锡的, 正锡的, 四价锡的
 mercurous ['mɜ:kjʊərəs] *adj.* 水银的, 亚汞的, 一价汞的
 mercuric [mɜ:'kju:ərɪk] *adj.* 汞的, 正汞的, 二价汞的
 cupric ['kju:pɪk] *adj.* 正铜的, 二价铜的
 monatomic [mɒnə'tɒmɪk] *adj.* 单原子的
 polyatomic [pɒliə'tɒmɪk] *adj.* 多原子的, 多元的
 oxyanion ['ɒksi'ænaɪən] *n.* 含氧阴离子
 hypobromite [haɪpəu'brəʊmaɪt] *n.* 次溴酸盐
 hypoiodite [haɪpəu'aɪədəɪt] *n.* 次碘酸盐 (酯)
 hypophosphite [haɪpəu'fɒsfəɪt] *n.* 次磷酸盐
 bromite ['brəʊmaɪt] *n.* 亚溴酸盐
 iodite ['aɪədəɪt] *n.* 亚碘酸盐
 bromate ['brəʊmeɪt] *n.* 溴酸盐
 perbromate [pə'brəʊmeɪt] *n.* 过溴酸盐
 periodate [pə'reɪədeɪt] *n.* 高碘酸盐
 acid ion 酸根离子
 chlorous acid ['klɔ:rəs] 亚氯酸
 perchloric acid [pə'klɔ:rɪk] 高氯酸
 hydrocyanic acid ['haɪdrəʊsaɪ'ænik] 氰氢酸

silicic [si'lisik] *adj.* 含硅的 ~ acid 硅酸
 arsenic ['ɑ:sənik] *adj.* 含砷的 ~ acid 砷酸
 permanganic [ˌpə:mæn 'gænik] *adj.* 含高价锰的 ~ acid 高锰酸
 phosphoric [fɒs'fɒrik] *adj.* 含磷的 ~ acid 磷酸
 borate ['bɔ:reit] *n.* 硼酸盐 (酯)
 boric ['bɔ:rik] *adj.* 含硼的 ~ acid 硼酸
 tellurate ['teljʊreit] 碲酸盐 (酯)
 telluric [te'ljuərik] *adj.* 含碲的 ~ acid 碲酸
 acid salt 酸式盐
 alkalinity [ˌælkə'lɪnɪti] *n.* 碱度, 碱性
 normal ['nɔ:məl] *adj.* 正常的, 当量的
 bisulfite [ˌbaɪ'sʌlfart] *n.* 酸性亚硫酸 (氢) 盐
 hydroxyl radical 氢氧根
 hydroxy group 羟基 (基团)
 basic salt ['beisik sɔ:lt] 碱式盐
 normal salt 中性盐, 正盐
 bismuth dihydroxynitrate ['bɪzməθ daɪhaɪ 'drɒksɪ'naitreit] *n.* 碱式硝酸铋
 sodium potassium sulfate 硝酸钠钾
 follow from ... 根据.....得出
 from ... on 从.....开始, 从.....起
 differentiate A from B 把 A 和 B 分开
 correspond to ... 相当于

Notes

In these cases the oxidation state of the metal is shown by a Roman numeral in parentheses immediately following the English name of the metal which corresponds to its oxidation number.

参考译文：在这种情况下，金属的氧化态用该金属的英文名称之后的圆括号中的罗马数字表示，该数字与金属的氧化数一致。

The students should have a good start in learning nomenclature if he has learned the Valence Table 2-1 which gives both charges on ions and names for the more common ones.

参考译文：化合价表 2-1 给出离子电荷数和较常见离子的名称；对它的了解有助于学生在命名法学习中有一个好的开端。

Exercises

1. Answer the following questions:

(1) How to name the compound of metal (oxides, bases and salts) using Stock system?

- (2) How to name nonmetal oxide?
2. Put the following into Chinese:
- | | | |
|-----------------|-------------|-----------|
| oxidation state | valence | acid salt |
| basic salt | normal salt | alkaline |
3. Put the following into English:
- | | | | | |
|-------|------|-------|----|-----|
| 无机化合物 | 中和反应 | 氢氧根离子 | 结晶 | 氧化物 |
|-------|------|-------|----|-----|
4. Give the IUPAC names of the following acids, base and salts :
- | | | | | | |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------------------------|-------------------|
| HClO | HClO ₃ | H ₂ SO ₃ | H ₂ SO ₄ | HNO ₂ | HNO ₃ |
| H ₃ PO ₄ | H ₃ BO ₃ | NaOH | Ca(OH) ₂ | KOH | ZnSO ₄ |
| NaNO ₂ | NaClO ₄ | NaHCO ₃ | CaSO ₃ | LiH ₂ PO ₄ | KHS |

5. Translation:

Many polyatomic anions contain oxygen in addition to another element. The number of oxygen atoms in such oxyanions is denoted by the use of the suffixes ite and ate, meaning fewer and more oxygen atoms, respectively. In cases where it is necessary to denote more than two oxyanions of the same element, the prefixes hypo and per, meaning still fewer and still more oxygen atoms, respectively, may be used.

Unit 3

Hydrogen Peroxide

Hydrogen peroxide (H_2O_2) is a very pale blue liquid which appears clear in a dilute solution, slightly more viscous than water. It has strong oxidizing properties and is therefore a powerful bleaching agent that has found use as a disinfectant, as an oxidizer, and in rocketry [particularly in high concentrations as high-test peroxide (HTP) as a monopropellant], and in bipropellant systems.

1. History

Hydrogen peroxide was first isolated in 1818 by Louis Jacques Thénard by reacting barium peroxide with nitric acid. An improved version of this process used hydrochloric acid, followed by sulfuric acid to precipitate the barium chloride byproduct. Thenard's process was used from the end of the 19th century until the middle of the 20th century. Modern manufacture methods are discussed below.

2. Uses

2.1 Industrial applications

About 50% of the world's production of hydrogen peroxide in 1994 was used for pulp- and paper-bleaching. Other bleaching applications are becoming more important as hydrogen peroxide is seen as an environmentally-benign alternative to chlorine-based bleaches.

Other major industrial applications for hydrogen peroxide include the manufacture of sodium percarbonate and sodium perborate, used as mild bleaches in laundry detergents. It is used in the production of certain organic peroxides such as dibenzoyl peroxide, used in polymerisations and other chemical processes. Hydrogen peroxide is also used in the production of epoxides such as propylene oxide. Reaction with carboxylic acids produces a corresponding "per-acid". Peracetic acid and *meta*-chloroperoxybenzoic acid (commonly abbreviated *m*CPBA) are prepared from acetic acid and *meta*-chlorobenzoic acid, respectively. The latter is commonly reacted with alkenes to give the corresponding epoxide.

2.2 Domestic uses

Diluted H_2O_2 (around 5%) is used to bleach human hair, hence the phrases peroxide blonde and bottle blonde. It can be absorbed into skin upon contacting and creating a local skin capillary embolism which appears as a temporary whitening of the skin. It whitens skeletons that are to be put on display. 3% H_2O_2 is used medically for cleaning wounds and removing dead tissue. The Food and Drug Administration has approved 3% hydrogen