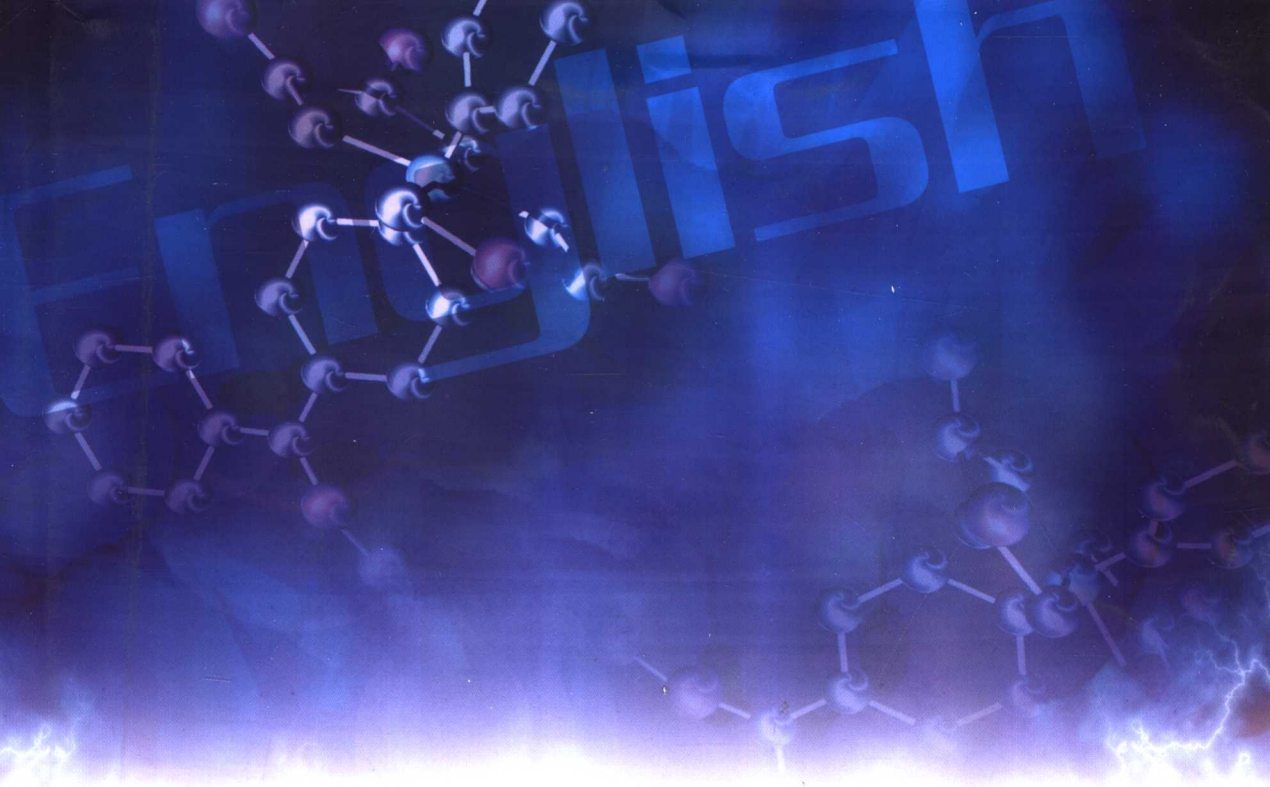

精细化工专业英语

Special English for Fine Chemicals

■ INTRODUCTION OF GENERAL CHEMICALS ■ SPECTROSCOPY OF ORGANIC COMPOUNDS
■ TECHNIQUES AND EXPERIMENTS FOR ORGANIC CHEMISTRY ■ FINE CHEMICALS ■ THE APPLICATION OF FINE CHEMICALS ■

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化学工业出版社

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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

Contents

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 Table1-1.

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[①]. 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 [②]. Such an arrangement is called a periodic table.

Table 1-1 IUPAC① names and symbols of the elements

Name		Symbol	At. No.	中文名
Actinium	[æk'tiniəm]	Ac	89	锕
Aluminum	[ə'lju:minəm]	Al	13	铝
Americium	[ˌæmə'risjəm]	Am	95	镅
Antimony	['æntiməni]	Sb	51	锑
Argon	['ɑ:gɔn]	Ar	18	氩
Arsenic	['ɑ:sənik]	As	33	砷
Astatine	['æstəti:n]	At	85	砹
Barium	['bɛəriəm]	Ba	56	钡
Berkelium	['bə:kliəm]	Bk	97	锫
Beryllium	[bə'riljəm]	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'bɔ:lt]	Co	27	钴
Copper	['kɔpə]	Cu	29	铜
Curium	['kjuəriəm]	Cm	96	锔
Dysprosium	[dis'prəusiəm]	Dy	66	镝
Einsteinium	[ain'stainiəm]	Es	99	锿
Erbium	['ə:biəm]	Er	68	铒
Europium	[juə'rəupiəm]	Eu	63	铕
Fermium	['fə:miəm]	Fm	100	镄
Fluorine	['fluəri:n]	F	9	氟
Francium	['frænsiəm]	Fr	87	钫
Gadolunium	[ˌgædə'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	['hɔlmiəm]	Ho	67	钬
Hydrogen	['haidrəudʒən]	H	1	氢
Indium	['indiəm]	In	49	铟
Iodine	['aiədi:n]	I	53	碘

续表

Name		Symbol	At. No.	中文名
Iridium	[i'ridiəm]	Ir	77	铱
Iron	['aiən]	Fe	26	铁
Krypton	['kriptɔn]	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	[ˌmendə'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	锘
Osmium	['ɔzmiəm]	Os	76	锇
Oxygen	['ɔksidʒən]	O	8	氧
Palladium	[pə'leidiəm]	Pb	46	钯
Phosphorus	['fɔsfərəs]	P	15	磷
Platinum	['plætinəm]	Pt	78	铂
Plutonium	[plu:'təuniəm]	Pu	94	钚
Polonium	[pə'ləuniəm]	Po	84	钋
Potassium	[pə'tæsiəm]	K	19	钾
Praseodymium	[ˌpreiziəu'dimiəm]	Pr	59	镨
Promethium	[prə'mi:θiəm]	Pm	61	钷
Protactinium	[ˌprəutæk'tiniəm]	Pa	91	镤
Radium	['reidjəm]	Ra	88	镭
Radon	['reidɔn]	Rn	86	氡
Rhenium	['ri:niəm]	Re	75	铼
Rhodium	['rəudiəm]	Rh	45	铑
Rubidium	[ru:'bidiəm]	Rb	37	铷
Ruthenium	[ru:'θi:niəm]	Ru	44	钌
Samarium	[sə'mɛəriəm]	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	['səudjəm]	Na	11	钠
Strontium	['strɔnʃiəm]	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	['zenɔn]	Xe	54	氙
Ytterbium	[i'tə:biəm]	Yb	70	镱
Yttrium	['itriəm]	Y	39	钇
Zinc	[ziŋk]	Zn	30	锌
Zirconium	[zə:'kəuniəm]	Zr	40	锆

① 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[③]. 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 ⅠA 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 ⅠB –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 ⅡA 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 ⅡB elements – zinc, cadmium, and mercury are less reactive than are those of group ⅡA, but they are more reactive than the neighboring elements of group ⅠB. The characteristic charge on their ions is also 2+.

With the exception of boron, group ⅢA 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 ⅢA form ions of 3+ charge. Group ⅢB consists of the metals scandium, yttrium, lanthanum, and actinium.

Group ⅣA 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 ⅣA atom, as, for example, carbon tetrachloride, CCl_4. The group ⅣB metals–titanium, zirconium, and hafnium–also form compounds in which each group ⅣB atom is combined with four other atoms; these compounds are nonelectrolytes when pure.

The elements of group ⅤA 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 ⅤB 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 ⅥA 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 ⅦA are all nonmetals and are known as the halogen, form 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 ⅥB, ⅦB 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 groups④.

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 ⅦA, 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 ['metəlɔid] *n.* 准金属
alkaline earth metal 碱土金属
non-electrolyte ['nɔn-i'lektrəulait] *n.* 非电解质
nitride ['naitraid] *n.* 氮化物

phosphide ['fɔsfaid] *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

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.
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。

② 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。

③ 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”。

④ 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 ⅣA 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 number①. 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 ones②. 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; $FeBr_2$ is iron (Ⅱ) bromide or ferrous bromide; $Ca(C_2H_3O_2)_2$ is calcium acetate; $Cr_2(SO_4)_3$ is chromium (Ⅲ) 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(Ⅰ)	Cu^+	calcium	Ca^{2+}	manganese (Ⅱ)	Mn^{2+}	chromium(Ⅲ)	Cr^{3+}
hydrogen	H^+	chromium (Ⅱ)	Cr^{2+}	mercury (Ⅱ)	Hg^{2+}	iron(Ⅲ)	Fe^{3+}
potassium	K^+	copper (Ⅱ)	Cu^{2+}	mercury (Ⅰ)	Hg_2^{2+}		
silver	Ag^+	iron (Ⅱ)	Fe^{2+}	tin (Ⅱ)	Sn^{2+}		
sodium	Na^+	lead (Ⅱ)	Pb^{2+}	strontium	Sr^{2+}		
				zinc	Zn^{2+}		

续表

3^-		2^-		1^-		1^-	
Arsenate	AsO_4^{3-}	carbonate	CO_3^{2-}	acetate	$C_2H_3O_2^-$	hydrogen sulfite	HSO_3^-
Arsenite	AsO_3^{3-}	chromate	$Cr_2O_7^{2-}$	bromide	Br^-	hydride	H^-
phosphate	PO_4^{3-}	dichromate	CrO_4^{2-}	chlorate	ClO_3^-	hydroxide	OH^-
phosphite	PO_3^{3-}	oxalate	$C_2O_4^{2-}$	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 (bicabonate)	HCO_3^-	permanganate	MnO_4^-
				hydrogen sulfate	HSO_4^-		

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

FeO	iron(Ⅱ) oxide	ferrous oxide
Fe_2O_3	iron(Ⅲ) oxide	ferric oxide
$Sn(OH)_2$	tin(Ⅱ) hydroxide	stannous hydroxide
$Sn(OH)_4$	tin(Ⅳ) hydroxide	stannic hydroxide
Hg_2SO_4	mercury(Ⅰ) sulfate	mercurous sulfate
$HgSO_4$	mercury(Ⅱ) sulfate	mercuric sulfate
NaClO	sodium hypochlorite	sodium hypochlorite
$K_2Cr_2O_7$	potassium dichromate	potassioum dichromate
$Cu_2(AsO_4)_3$	copper(Ⅱ) arsenate	cupric arsenate
$Cr(C_2H_3O_2)_3$	chromium(Ⅲ) 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 denoted 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^-	hypophophite	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) hepata-, (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(Ⅱ) oxide	carbon monoxide
CO_2	carbon(Ⅳ) oxide	carbon dioxide
SO_3	culfur(Ⅵ)	sulfur trioxide
N_2O_3	nitrogen(Ⅲ) oxide	dinitrogen trioxide
P_2O_5	phosphorus(Ⅴ) oxide	diphosphorus pentoxide
Cl_2O_7	chlorine(Ⅶ) 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 H_2SO_4, is sulfuric acid rather than sulfic. Similarly, H_3PO_4, 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
$HC_2H_3O_2$	$C_2H_3O_2^-$, acetate	acetic acid
H_2CO_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_4SiO_4	SiO_4^{4-}, silicate	silicic acid
H_3AsO_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

$$NaOH+H_2SO_4 \longrightarrow NaHSO_4+H_2O$$

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 di- hydrogen 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 $Ca(HSO_3)_2$ 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:

$$Ca(OH)_2+HCl \longrightarrow Ca(OH)Cl+H_2O$$

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 $Bi(OH)_2NO_3$ 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, $NaNH_4HPO_4$ 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'menklətʃə] *n.* 命名法，术语
iron(Ⅱ) bromide ['aiən 'brəumaid] *n.* 溴化亚铁
ferrous ['ferəs] *adj.* 铁的，含铁的，亚铁的　　~bromide　溴化亚铁

calcium acetate ['kælsiəm 'æsi,teit] *n.* 醋酸钙
chromium(Ⅲ) sulfate ['krəumjəm 'sʌlfeit] *n.* 硫酸铬
chromic ['krəumik] *adj.* 含三价的铬的，铬的
arsenate ['ɑ:sinit] *n.* 砒酸盐，砷酸盐
arsenite ['ɑ:sinait] *n.* 亚砷酸盐
phosphite ['fɔsfait] *n.* 亚磷酸盐
chromate ['krəumeit] *n.* 铬酸盐
oxalate ['ɔksəleit] *n.* 草酸盐
dichromate [dai'krəumeit] *n.* 重铬酸盐
sulfite ['sʌlfait] = sulphite *n.* 亚硫酸盐
chlorate ['klɔ:rit] *n.* 氯酸盐
chlorite ['klɔ:rait] *n.* 亚氯酸盐
cyanide ['saiənaid] *n.* 氰化物
hydrogen carbonate 酸式碳酸盐
bicarbonate [bai'kɑ:bənit] 酸式碳酸盐
hydrogen sulfate ['haidrəudʒən 'sʌlfeit] 酸式硫酸盐
bisulfate [bai'sʌlfeit] 酸式硫酸盐
hydrogen sulfite 酸式亚硫酸盐
hydride ['haidraid] *n.* 氢化物
hypochlorite [ˌhaipəu'klɔ:rait] *n.* 次氯酸盐
iodate ['aiədeit] *n.* 碘酸盐
nitrite ['naitrait] *n.* 亚硝酸盐（酯）
perchlorate [pə'klɔ:reit] *n.* 高氯酸盐
ferric ['ferik] *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 ['mə:kjurəs] *adj.* 水银的，亚汞的，一价汞的
mercuric [mə:'kjuərik] *adj.* 汞的，正汞的，二价汞的
cupric ['kju:prik] *adj.* 正铜的，二价铜的
monatomic [ˌmɔnə'tɔmik] *adj.* 单原子的
polyatomic [ˌpɔliə'tɔmik] *adj.* 多原子的，多元的
oxyanion ['ɔksi'ænaiən] *n.* 含氧阴离子
hypobromite [ˌhaipəu'brəumait] *n.* 次溴酸盐
hypoiodite [ˌhaipəu'aiədait] *n.* 次碘酸盐（酯）
hypophosphite [ˌhaipəu'fɔsfait] *n.* 次磷酸盐
bromite ['broumait] *n.* 亚溴酸盐
iodite ['aiədait] *n.* 亚碘酸盐
bromate ['brəumeit] *n.* 溴酸盐
perbromate [pə'brəumeit] *n.* 过溴酸盐
periodate [pe'raiədeit] *n.* 高碘酸盐
acid ion 酸根离子
chlorous acid ['klɔ:rəs] 亚氯酸
perchloric acid [pə'klɔ:rik] 高氯酸
hydrocyanic acid ['haidrəusai'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 [fɔs'fɔrik] *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 ['teljureit] 碲酸盐（酯）
telluric [te'ljuərik] *adj.* 含碲的 ～acid 碲酸
acid salt 酸式盐
alkalinity [ˌælkə'liniti] *n.* 碱度，碱性
normal ['nɔ:məl] *adj.* 正常的，当量的
bisulfite [ˌbai'sʌlfait] *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 ['bizməθ daihai' drɔksi'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

① 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。

② 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: