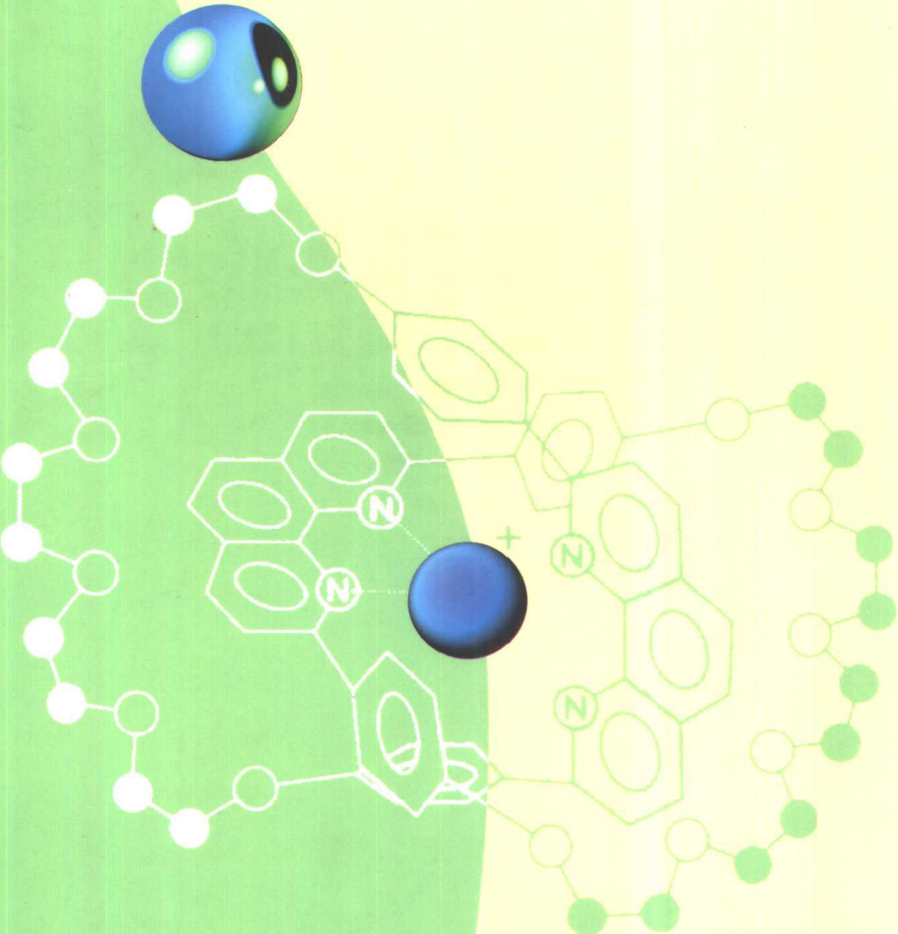
北京大学专业英语丛书

化学专业基础英语 I

INTRODUCTORY CHEMISTRY SPECIALITY ENGLISH

魏高原 编
by Gaoyuan Wei



北京大学出版社

北京大学专业英语丛书

化学专业基础英语(Ⅰ)

INTRODUCTORY CHEMISTRY SPECIALITY ENGLISH

魏高原　编
by Gaoyuan Wei

北 京 大 学 出 版 社
北　　京

图书在版编目(CIP)数据

化学专业基础英语(Ⅰ)/魏高原编著. —北京：北京大学出版社，2001.4
ISBN 7-301-04747-9

Ⅰ.化… Ⅱ.魏… Ⅲ.化学-英语-高等学校-教材 Ⅳ.H31

中国版本图书馆 CIP 数据核字(2000)第 71873 号

书　　　名：化学专业基础英语(Ⅰ)
著作责任者：魏高原
责 任 编 辑：赵学范
标 准 书 号：ISBN 7-301-04747-9/H·570
出　版　者：北京大学出版社
地　　　址：北京市海淀区中关村北京大学校内　100871
网　　　址：http://cbs.pku.edu.cn
电　　　话：出版部 62752015　发行部 62754140　编辑室 62752021
电 子 信 箱：zpup@pup.pku.edu.cn
排　版　者：兴盛达打字服务社　(62549189)
印　刷　者：世界知识印刷厂
发　行　者：北京大学出版社
经　销　者：新华书店
787 毫米×1092 毫米　16 开本　15.75 印张　450 千字
2001 年 4 月第 1 版　2001 年 4 月第 1 次印刷
定　　　价：25.00 元

内容简介

本教材根据北京大学化学学院试用多年的讲义修订而成，无论从内容取舍还是从教学目的上看都是有开创性的。本书在内容编排上试图训练学生在系统掌握专业英语词汇的基础上，学会用英语进行科学思维。经北大化学院多年教学使用，受到学生普遍欢迎。全书45万字，分成基础化学讲座、重要专业术语和化学文献选讲及附录四部分。附录中为读者提供了习题答案和试题、基本化学术语总汇以及一些阅读、会话、写作和翻译用资料及提高听力用的化学录像和光盘目录。

本书可与化学专业基础英语(II)配套使用——在接受本书的系统学习同时(或之后)，如辅以基础英语(II)的配合，读者则不难在领略多彩的化学世界前沿领域的同时，全面提高专业英语水平。

本书可作为大专院校化学及相关专业高年级学生专业英语教材或主要参考书，也可作为理工类研究生和教师以及一般科研人员的实用科技英语参考读物。

前 言
(Preface)

《化学专业基础英语》(I)是根据教育部批准的《大学英语教学大纲》关于专业英语教学的要求和编者本人多年化学专业英语教学实践而编写的一部教材。该教材已在北京大学化学学院试用过七个学期,受到学生普遍欢迎。

该教材的目的是培养学习者在化学专业英语方面的较强的读、写、译的能力,并适当训练听、说的能力,不是单纯培养阅读能力。教材分三个部分:基础化学讲座、重要专业术语、化学文献选讲。附录部分包括总词汇表,习题答案,会话材料,翻译材料,常见化学单位、常数等的英文表达方式,常见科技英语语法结构等。

该教材的文章全部选自原文材料,有一定难度。文章内容虽然是有关化学,但不枯燥,文字优雅。教材覆盖化学专业所必须的基础知识和重要词汇和语法现象,并突出化学专业英语文献在文章结构、文字表达方面的特点。这一切都有利于学习者提高英语、迅速掌握化学专业英语。

该教材的练习形式新颖,突出实用,使学习者既能获得必要的化学知识以及解决问题的能力,又能发表个人独立的观点,在读、写、译方面得到训练,并且能通过对文章和议题的确切理解和对观点的独立、精确的表达,培养科学精神。具体说来,编者希望通过使用本教材后,学习者能不借助字典读懂内容不十分专业的科技期刊如 Nature 和 Science 的文章,能写出一篇科技文章的摘要及小论文或能与同行进行有效的书信往来,能听懂一般化学方面的演讲或讲课,能与外国同行进行化学专业方面的口头交流,并能胜任专业知识方面的中英双向口译和笔译。

该教材设有考试样题。练习题和考试题大部分选自美国著名大学同类专业的教材,对学习者是一种挑战。练习题和考试题都附有答案。

该教材可作为大学化学专业英语教材,也可作为化学类基础课的英文教材。该教材可安排在三年级,用一个学期(18 周,周学时 2)教完。教学重点应是培养较强的化学专业英语的读、写、译的能力。在使用该教材的过程中,教师可针对学习者的情况,采用灵活的教学方式,参照教育部《大学英语教学大纲》关于专业英语教学各项指标要求。在有条件的院校,可用全英语授课,给学习者全面的化学英语训练。

该教材的后续教材《化学专业基础英语》(II)选用了美国普林斯顿大学出版社的原版书《设计分子世界——化学前沿》(作者 Philip Ball)。各章配有内容提要、词汇表和难句解释和翻译,使学习者进一步提高化学专业英语水平,并了解当今化学领域的新成果、新思想。

安美华
北京大学英语系
2001 年 3 月 25 日

编者的话
(Words from the Editor)

现代通讯和运输工具正使"地球村"这一设想日益变成现实,而同村的人必须能够进行有效的语言交流。尽管具有悠久历史的象形文字——中国汉字在计算机技术出现之前,一直难以为非华语使用者广泛应用,但相信在不久的将来,必定会有更多的地球村人能够使用这一令中华民族引以为豪的语言文字。不过,由于众所周知的原因,可以预见在未来二三十年内,英语仍将作为国际交往中使用最普遍的一种语言,特别对科学技术领域更是如此。更考虑到落实"科教兴国"战略的需要,并且教育部又于 1999 年 6 月颁布了新的大学英语教学大纲,新大纲明确规定:"学生在完成基础阶段的学习任务,达到四级或六级后,都必须修读专业英语,以便从学习阶段过渡到应用阶段"。大纲还将专业英语定为必修课,要求教学时数不少于 100 学时。此外,大纲对应用提高阶段中在词汇、读、听、说、写、译等方面提出了具体要求。本教材的编写正是在此大背景下,应运而生,期望能在起到抛砖引玉作用的同时,缓解目前高校新型化学专业英语教材紧缺这一燃眉之急。

本教材是在 1993 年秋由编者完成的北京大学化学系化学专业英语课讲义《ENGLISH FOR CHEMISTRY STUDENTS——LECTURE NOTES》(胶印版)基础上整理、增补而成。新教材保留了原教材的风格,即突出对学生用英语进行科学思考的能力的训练。全书共 16 章,分成以下三大部分内容:基础化学讲座、重要专业术语和化学文献选讲。第一部分(第 1～7 章)内容的安排在国内抑或在全世界尚属首次,这主要是考虑到了编者本人在专业英语学习过程中所积累的一些经验。特别是每章后面所附普通化学习题练习(家庭作业)更系编者本人在国外攻读学位期间应用过的一种行之有效的学习专业英语的方法。同时,所教过的学生对此部分的内容普遍表示欢迎。第二部分(第 8～13 章)主要是为了扩大学生的专业词汇,以及训练学生准确理解专业术语精确定义的能力。第三部分(第 14～16 章)提供了若干有代表性的化学专业文献供选读,主要目的是让学生获得快速理解不同类型专业文献的技巧。最后,特别值得一提的是,本教材还在第四部分附录中为读者提供了较多的参考和补充资料,特别是在"基本化学术语总汇"中列出了本教材中出现的所有基础专业术语,相信会对读者在化学专业术语的掌握方面进行自我测试带来方便。此外,专业英语电化教学方面的参考资料在附录中有所提及,但限于篇幅,未能提供更多资料,希望将来能有这方面的专门教材问世。鉴于本教材属化学专业英语的入门教材,若能与同由北京大学出版社出版的《化学专业基础英语(II)——设计分子世界:化学前沿》(已列入北京大学专业英语丛书)联用,则效果会更好。

尽管本教材的主要内容已经在北京大学化学与分子工程学院讲授了 7 个学期,但由于属首次尝试,再加上时间仓促,错漏等不完善之处在所难免,敬请读者不吝指正。

本书能以今天的面貌出现,是与众多领导、师生和亲友的支持和帮助分不开的。编者特别感谢原化学系主管教学的副系主任常文保教授在过去几年里从各方面所给予的支持、鼓励和帮助,以及北京大学出版社领导和本书责任编辑赵学范老师在为使本书得以如期出版方面所

给予的大力支持和帮助。责编的高度敬业精神和高超编辑水平十分令人感动和钦佩。北京大学英语系安美华教授在使编者学会如何教好专业英语方面给予很多宝贵的指点。化学学院的同行也给予编者很大帮助,这里要特别提到的有张榕森、甘良兵和王剑波,后者还试用过编者编写的胶印版讲义,并提出过宝贵的改进建议。还有编者所教过的数百名本科生的宝贵批评和鼓励意见,更是编者坚持将此教材完成的强大驱动力。最后,编者还要感谢夫人在过去几年里所给予的支持和谅解。事实上,没有她的宝贵理解,也许根本就没有前述胶印版讲义的面世。

在本教材的编写过程中,编者引用了众多科技英语、期刊、教材、专著等英文原版参考文献中的有用部分。这些文献包括: *Chemistry*(2nd ed., John C. Bailar, Jr. et. al., Academic Press, Orlando, Florida, 1984—本教材的主要参考书)、*Fundamentals of Analytical Chemistry* (Douglas. A. Skoog and Donald M. West, Holt, Rinehart and Winston, Inc., 1963)、*Polymer Chemistry: The Basic Concepts* (Paul C. Hiemenz, Marcel Dekker, Inc., New York, 1984)、*Principles of Polymer Chemistry* (Paul J. Flory, Cornell University Press, Ithaca, New York, 1953)、*Biophysical Chemistry Part I: The Conformation of Bilogical Macromolecules* (Charles R. Cantor and Paul R. Schimmel, W. H. Freeman and Co., San Francisco, 1980)、*Scientifically Speaking: An Introduction to the English of Science and Technology* (B. C. Brookes, Bob Kesten, Viola Huggins, B. B. C. English by Radio and Television & The Chaucer Press, UK, 1971)和 *A Course in Basic Scientific English* (J. R. Ewer and G. Latorre, Longman Group Ltd, London, 1969 & 1976)。在此,对作者和出版商们的支持表示衷心的感谢。

魏高原
1999.6.26
于燕园

目　录
CONTENTS

第二部分(Part II) 重要专业术语(Significant Terms)

第三部分(Part III) 化学文献选讲(Chemical Literature)

第四部分(Part IV) 附录(Appendices)

第一部分（Part I）

基础化学讲座
（Chemistry Lectures）

原书空白页

第1章 化学的本质

The Nature of Chemistry

The following is a letter to a friend from John C. Bailar, Jr. , who has been a member of the chemistry department faculty at the University of Illinois for 56 years.

Dear Chris:

This letter is an answer to your questions about just what chemistry is and what chemists do. I'm glad that you asked, for many people have a distorted, or at least superficial, view of what the subject is all about. Whether I can give you a clear picture of it in a letter like this, I am not sure, but I shall try.

You know, of course, that chemistry is one of the **physical sciences**, along with physics, geology, and astronomy. Closely related, but in a somewhat different category, are the **biological sciences**, such as botany, physiology, ecology, and genetics. There is no sharp distinction between the two groups of sciences, or between those in either group, for they overlap each other. Often it is difficult to decide whether a specific topic belongs in one area or another. Many important subjects fall within the boundaries of several different disciplines. [Definitions of terms given in boldface type are listed at the end of this letter.]

All of the sciences overlap extensively with chemistry: they depend upon it and, in large measure, are based upon it. By that I mean that chemistry is really a part of all of the natural sciences, and a person cannot go very far in any science without some knowledge of chemistry. It would be possible to be a chemist without much knowledge of astronomy or physiology, but certainly, one could not make great progress in astronomy or physiology without some understanding of chemistry. A knowledge of chemistry is essential in other scientific fields as well. Agriculturists, engineers, and medical doctors use chemical concepts constantly.

Chemistry is concerned with the composition of **matter** and the changes in composition which matter undergoes — in brief, chemistry is the science of matter. Physics is concerned chiefly with energy and with the interactions of matter and energy, including energy in such forms as heat, light, sound, electricity, mechanical energy, and nuclear energy. All changes in the composition of matter either release or absorb energy and for this reason the relationship between chemistry and physics is a most intimate one.

We think of any change in which the composition of matter changes as a **chemical**

change. For example, if you pour vinegar on baking soda in a glass vessel, you will see bubbles of gas escaping and the liquid will become warm as energy is released. When the bubbling stops, you can evaporate the liquid by boiling it, until finally only a white powder remains. But this white powder is not the original baking soda. It is a new substance with new characteristics. For example, it won't give off bubbles if you pour vinegar on it. This new material is different in composition from either of the materials which you originally mixed together. A chemical change has taken place.

By contrast, a **physical change** does not involve a change in the composition of matter. The melting of ice or the stretching of a rubber band are physical changes. It is often impossible to say whether a particular change is chemical or physical. Happily, it is not usually necessary to make a clear distinction between the two.

You must not assume that in your first course in chemistry you'll learn about the chemistry of the digestion of food or how a mixture of cement and water sets and hardens. These are complex processes, and before one can understand them one must first learn the chemistry of simpler substances. In learning to play the piano, a student does not start with Rachmaninoff's *Prelude in C# Minor*. A music student must first learn to play scales, and then simple pieces. It is only after months or years of practice that an individual can play the music of the masters. So it is with chemistry. You must first learn the fundamental principles and something about simple substances such as water and oxygen. A good understanding of the behavior of such substances will then allow you to understand the chemical behavior of more complex materials.

The science of chemistry is so broad that no one can be expert in all of its aspects. It is necessary to study the different branches of chemistry separately, and, if you become a chemist, to specialize in one or two branches of the subject.

Until about 150 years ago, it was believed that inanimate matter and living matter were of entirely different natures and had different origins. The inanimate matter was referred to as "inorganic" (meaning "without life") and the living matter and material derived from living matter were called "organic." However, in 1828, a German chemist named Friedrich Wöhler heated a material which was known to be inorganic and obtained a substance which all chemists recognized to be a product formed in life processes. So the distinction between "inorganic" and "organic" broke down. We still use these terms, but they now have different meanings from those they had in the early days. All living matter contains carbon chemically combined with hydrogen, so the chemistry of chemical compounds of carbon and hydrogen, whatever their origin, is called **organic chemistry**. Substances that do not contain carbon combined with hydrogen are "inorganic," and their chemistry is called **inorganic chemistry**. Carbon is very versatile in its behavior and is a key substance in a great many compounds, including most of the compounds essential to life.

There are other branches of chemistry, too. *Analytical chemistry* is concerned with the detection or identification of what substances are present in a material (**qualitative analysis**) and how much of each is present (**quantitative analysis**). *Physical chemistry* is the application of the methods and theories of physics to the study of chemical changes and the properties of matter. Physical chemistry really forms the foundation for all of the other branches of the subject. *Biochemistry*, as the name implies, is concerned with the chemistry of the processes that take place in living things.

Inorganic, organic, analytical, physical chemistry, and biochemistry are the main branches of chemistry, but it is possible to combine portions of them, or to elaborate on them in many ways. For example, *Bioinorganic chemistry* deals with the function of the metals that are present in living matter and that are essential to life. *Pharmaceutical chemistry* is concerned with drugs: their manufacture, their composition, and their effects upon the body. *Clinical chemistry* is concerned chiefly with the analysis of blood, urine, and other biological materials. *Polymer chemistry* deals with the formation and behavior of such substances as rayon, nylon, and rubber. (Some people would include inorganic polymers such as glass and quartz.) *Environmental chemistry*, of course, deals with the composition of the atmosphere and the purity of water supplies—essentially, with the chemistry of our surroundings. *Agricultural chemistry* is concerned with fertilizers, pesticides, plant growth, the nutrition of farm animals, and every other chemical topic that is involved in farming.

One more topic should be mentioned. This is *chemical engineering*, which is concerned with the applications of chemistry on a large scale. Chemical engineers design and operate chemical factories; they deal with the economics of making chemicals on a commercial scale. They are also concerned with such processes as distilling, grinding, and drying materials in large amounts—even the study of the friction of liquids and gases flowing through pipes.

Before you can undertake the study of any of these broad fields of chemistry, you will need to take a course, usually called "General Chemistry," which is the basis for more specialized study. You will quickly learn that general chemistry consists of two interrelated parts: **descriptive chemistry** and **principles of chemistry**.

Descriptive chemistry generally deals with the "What...?" questions: What does that substance look like? What happens when it is heated? What happens when an electric current flows through it? What occurs when it is mixed with another specific substance? Chemistry is an experimental science and chemists work with a great many substances. It is important that they know the nature of these substances: their solubility in water or other liquids, their flammability, their toxicity, whether they undergo chemical changes in damp air, and many other characteristics. Sometimes the availability and cost of a substance are also important. The descriptive part of the general chemistry course is concerned chiefly with the behavior of some of the simpler inorganic substances, but often includes brief discussions of organic and biochemical materials as well.

The *principles* part of the course is concerned with theories of chemical behavior. That is, it attempts to answer the "Why...?" questions: Why won't a substance dissolve in water? Why did an explosion take place when a mixture was heated? Why was a particular substance and not a different one formed in a chemical change? Why does a chemical change speed up dramatically if a tiny amount of something else is added?

The study of chemical principles is of great practical as well as intellectual interest. We can, for example, calculate how much heat is given off when a particular fuel burns, and determine how to speed up or slow down its combustion. When we know why certain substances behave as they do we can often modify their behavior to achieve desirable or useful results.

Chemistry is an experimental science. By this statement, I do not mean that chemists do not have theories about changes in chemical composition—under what conditions they will or will not take place, how they take place, and what the products will be. There are always theories. But **theory** must always be subject to experiment. If one's theory is not in accordance with carefully executed experiments, then the theory, not the experiment, must be wrong. The theory must then be abandoned or modified. In this regard, chemistry is quite different from the social sciences, such as sociology and economics. People who work in those fields may have theories about the causes of inflation or unemployment or marital unhappiness, and they may carry out experiments to test their theories. But these experiments can never be repeated and checked under the same conditions, for in the act of doing the experiment the conditions have been irretrievably changed. This is true to some extent also in the biological sciences. A pharmacologist may test the effect of a given drug on a mouse and draw some conclusions from what happens to the mouse. But he cannot repeat the experiment with that same mouse, for he cannot be sure that the health of the mouse has not been changed by the first administration of the drug. He can do the experiment with another mouse, but he cannot be sure that the second mouse will respond exactly as the first one did. Chemists are more fortunate; under the same conditions, pure chemicals will always react with each other in exactly the same way. The trick is to be sure that the chemicals are pure and that the conditions of the experiment are exactly the same.

But, you will ask, "Just what do chemists do?" That is a difficult question to answer, for chemists do many different things. About half of the chemists in the United States work in laboratories. Some of them are "quality control" chemists. By a variety of laboratory techniques (some simple and some complex), they analyze or otherwise test