大学英语应用提高阶段专业英语系列教材

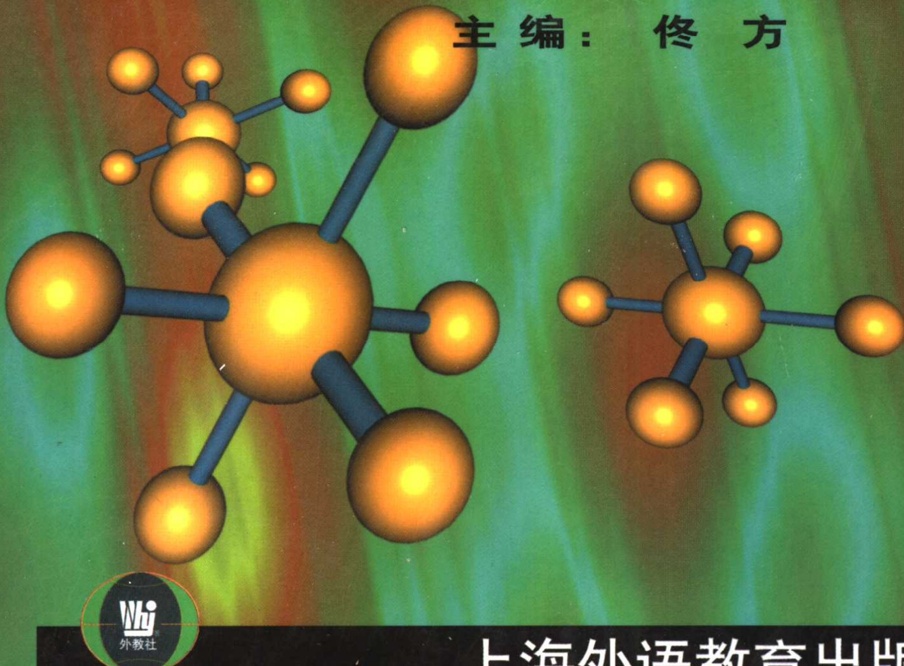
新世纪理工科英语教程

总主编：程月芳　　顾问：Geoff Thompson（英国）

[化学和化工]（学生用书）

Chemistry and Chemical Engineering

主编：佟方



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Chemistry and Chemical Engineering

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前　　言

大学英语教学大纲(修订本)规定大学英语教学分为基础阶段(一至二年级)和应用提高阶段(三至四年级)。应用提高阶段的教学包括专业英语(Subject-Based English,简称SBE)和高级英语(Advanced English,简称 AE)两部分。大纲明确指出:“大学英语教学的目的是培养学生具有较强的阅读能力和一定的听、说、写、译能力使他们能用英语交流信息。……以适应社会发展和经济建设的需要。”新世纪对人才在外语方面提出了更高的要求。抓好大学英语应用提高阶段的教学已势在必行。编写本教材的目的是帮助理工科学生在应用提高阶段进一步发展、巩固和提高基础阶段已掌握的读、听、写、说、译五种技能,并使部分有一定口语基础的学生在听说能力方面也能有较大的提高,以适应 21 世纪对高级人才的需求。

本教材主要适用于已完成基础阶段学习的高等学校理工科本科生,为应用提高阶段的必修课和选修课教材。也可用作研究生教学或工程技术人员的外语培训教材。

全套教材由专业教师和英语教师合作编写而成。它以英国语言学家 H. G. Widdowson 的交际法理论为依据,着重解决语言运用能力的培养问题,使学生将基础阶段已掌握的英语语言知识和技能在自己的专业领域中得到进一步实践和应用,从而达到能以英语为工具获取和交流信息的教学目的。

全套教材由以下十个分册组成:

1. *Mechanical Engineering*《机械工程》,吉林工业大学编写。
2. *Electrical and Electronic Engineering*《电气与电子工程》,燕山大学编写。
3. *Computer Engineering*《计算机工程》,南开大学编写。
4. *Materials Science and Engineenng*《材料科学与工程》,天津大学编写。
5. *Civil Engineering and Architecture*《土木工程与建筑》,大连理工大学编写。
6. *Chemistry and Chemical Engineering*《化学和化工》,华东理工大学编写。
7. *Power Engineering*《动力工程》,上海理工大学编写。
8. *Business Administration*《工商管理》,湖南大学编写。
9. *Engineering Talk*《工程师会话》,上海理工大学编写。
10. *Practical Writing and Translation Guidance*《写作与翻译指导》,燕山大学和华东理工大学编写。

其中 1—8 分册为专业英语(SBE)必修课教材,旨在使学生通过有关专业题材文章的阅读和训练,不仅能提高英语水平,而且还能学到一定的专业知识,了解一些该专业的信息动态,熟悉和了解专业题材文章的语言特点,掌握一定量的专业词汇。在教材的练习编写上力

求做到新颖多样且实用，并在信息转换和语言表达方式转换能力的训练上下功夫。学生可以通过各种练习在读、听、写、说、译诸方面得到锻炼。实用文写作训练更应注重实用，旨在提高学生的书面表达能力，并向学生提供信函、实验报告、摘要、论文等实用文的表达模式和实例，以便他们在实际使用时作参考。八个分册写作部分原则上相同。

第9分册《工程师会话》作应用提高阶段高级英语(AE)选修课教材，旨在使一些学有余力且在会话方面较有培养前途的学生在口头交际能力上得到训练和提高。选材力求实用，尽量提供一些工程技术人员在实际工作中会遇到的题材，以使他们参加工作后能较快地适应英语口头交际的需要。

第10分册《写作与翻译指导》为教学辅导材料。供教师和学生在教学和学习中作参考。

全套理工科教程由吉林工业大学、大连理工大学、燕山大学、南开大学、天津大学、华东理工大学、上海理工大学、湖南大学合作编写。上海理工大学程月芳教授担任总主编。英国利物浦大学英语语言文学系专家 Mr. Geoff Thompson 担任顾问并协助审校。Mr. Geoff Thompson 和上海交通大学杨惠中教授对教材编写提出了许多宝贵意见。在教材编写的全过程中，上海外语教育出版社社长庄智象教授和编辑室陈鑫源主任给予了大力的支持和帮助。特此表示衷心的感谢。

本书为 *Chemistry and Chemical Engineering* 分册，由华东理工大学佟方担任主编。吴达俊、庄思永、黄淑芳、华静、丁国声为编者，王亚平副教授为主审。其中吴达俊教授、庄思永教授负责材料的收集和译文的审校及部分实用文写作实例的补充，佟方老师除负责练习编写中的组织审校工作外，还编写了 U.1—U.10 和 U.12 的练习。黄淑芳编写 U.11，U.13—U.15 的练习，U.20 阅读与实践部分的练习和 Glossary 的编排。华静编写 U.16—U.19 的练习和 U.20 阅读与理解，阅读与翻译部分的练习。实用文写作由燕山大学丁国声教授统一编写。

由于编者水平有限，教材中不妥之处望广大使用者提出宝贵意见。

新世纪理工科英语教程编委暨

编　者

2001年12月

使用说明

本书为 *Chemistry and Chemical Engineering* 分册，供化学和化工及相关专业的大学本科学生作专业英语（Subject-Based English，简称 SBE）即大学第 5，6 学期教材，约需 68 学时。

本书分 Text（课文），Practical Writing（实用文写作）和 Glossary（生词表）3 部分。Text（书中不注明）分 20 个单元，每个单元由 Reading and Comprehension，Reading and Practice 和 Reading and Translation 3 部分组成。全书选材面向 21 世纪的要求，以反映时代特色。材料选自国外原版教材、文选、论著、会议论文、实用文件、报刊杂志等。内容涉及化学和化工及相关专业的基本物理概念，基础工程知识，发展简史或重大发明创造，人物传记，重要组织机构简介以及发展动向。

Reading and Comprehension 部分旨在培养和提高学生阅读和理解专业英语科技文献的能力。它由一篇 1,000～1,500 词的阅读文章和若干练习组成。选材注重科学性、可读性、知识性、趣味性和实用性。文章之后附有生词表，将大纲四级词表之外的词汇和专业术语按出现先后次序列出。对一些较复杂的问题或术语的注释在文章之后以 Notes 的形式出现。通过练习要求学生掌握文章的中心思想和要点，并就文章内容进行预测、分析、推理、判断和综合概括，及分析篇章结构等。

Reading and Practice 部分由一篇 1,000～1,500 词的阅读文章和四项练习 Exercise A、B、C、D 组成，旨在为学生提供运用语言的实践机会。选材偏重专业基础知识。练习按阅读材料的内容设计。文章之后附有生词表，列表方式与前一部分相同。Exercise A、B 偏重学生的语言能力训练。Exercise C 为听力练习，旨在训练学生的听说能力。学生在听完一篇 150～200 词的短文后需回答问题、复述文章内容、或进行 Dictation、Spot Dictation 或 Compound Dictation 等练习。Exercise D 是重点，着重训练学生运用已掌握的语言知识和技能较准确地表达与专业有关的思想和概念的能力。该部分除围绕科技文章中经常出现的语言现象，如：定义、分类、描述、指令、论证、概括、举例、逻辑关系表达、计量与计算、数据表达与理解等某一功能意念或语言现象进行操练外，还包括参阅技能、通篇浏览、查找信息等学习技能的培养。练习设计打破了旧框框，将读、听、写、说四种技能的训练相互交融，使它们在专业领域中得到综合运用。

Reading and Translation 部分是为训练学生的翻译能力而设计的。A 为汉译英练习，以句子翻译为主，逐步过渡到段落和篇章的翻译。B 为英译汉练习。有一篇约 1,000 词的文章，要求学生将划线部分译成汉语。翻译中学生不仅要注意句子的译法，而且还须注意句子在上下文中的意思。

Practical Writing 部分除写作指导和练习外，还向学生提供信函、实验报告、摘要、论文等应用文的表达模式，以便他们在实际使用时作参考。该部分集中放在书后，以便自成体系，便于学生参考使用。教师应选用相应章节对学生进行训练。该部分的注释、常用表达方式、练习答案和补充范例请参阅第 10 分册《写作与翻译指导》。

Glossary 将生词表中出现的所有单词按字母顺序排列并注明词性、词义和所在单元，便于学生复习和查找。

本书阅读总量约 100,000 词，总生词量为 1,000。讲课时教师应注重读、听、写、说、译综合技能的训练和交际能力的培养。学生宜在课前做好预习工作。由于阅读量和练习量较大，教师可按学生的实际情况安排教学，对教材进行有选择的使用。

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Unit One

Reading and Comprehension

Chemistry As a Science

Chemical Reactions

Chemistry is especially concerned with learning and understanding the *changes* that take place between chemicals, changes that we call chemical reactions. In a chemical reaction, chemicals interact with each other to form entirely *different* substances with different properties. Sometimes these changes can be quite dramatic, as illustrated by the reaction of sodium with chlorine.

Sodium is a metal. Like other metals, it is shiny and conducts electricity well. Unlike other metals, though, it is very soft and is easily cut with a knife. Notice that the outside of the bar of sodium is coated with a white film. This was formed by the reaction of sodium with oxygen and moisture in the air. The tendency of sodium to react rapidly with oxygen and water makes it a dangerous chemical with which to work. Sodium reacts violently in water, producing a lot of heat and liberating the flammable gas hydrogen. In this same reaction sodium also forms a substance called sodium hydroxide, commonly known as lye, which is very corrosive toward flesh. Contact of sodium with your skin can cause severe chemical burns.

Chlorine is different from sodium in many ways. It is a pale, yellow-green gas. If you've ever smelled a liquid laundry bleach such as Clorox, you have smelled chlorine, which escapes from the bleach in small amounts. In concentrated form chlorine is especially dangerous to inhale, causing severe lung damage that can easily lead to death. In fact, chlorine gas has been used as a weapon of war.

When metallic sodium and gaseous chlorine come together they react violently. The substance formed in this reaction is a white powder, quite different in appearance from either sodium or chlorine. Its chemical name is sodium chloride, *although it's known to* most people by its common name, *salt*.

If you think about this reaction for a moment, perhaps it will strike you as really quite amazing, and even a bit like magic. Here we have two chemicals, sodium and chlorine, whose ingestion can produce severe medical problems or even death. Yet, when they react with each other they form a substance our bodies cannot do without! Such startling events help make chemistry fascinating. As you study this course, perhaps you will discover for yourself that same sense of magic that has caught the imagination of others and produced generations of chemists.

Most chemical reactions are not quite as spectacular as the one between sodium and chlorine. Nevertheless, they take place in us and around us all the time. We metabolize the foods we consume, while photosynthesis creates their replacements. Chemical reactions in batteries supply us with energy as does the combustion of fuels. Chemical reactions in the air lead to smog, while in the upper atmosphere sunlight interacting with gases released from aerosol cans and damaged air conditioners degrades the natural ozone layer that shields the Earth from harmful ultraviolet radiation. Understanding these reactions and seeking to control the ones that can be harmful to us is an important role for chemistry in modern science and in our society.

The Scientific Method and How It Relates to Chemistry

As a science, chemistry is a dynamic subject, constantly changing as new discoveries are made by scientists who work in university and industrial laboratories. The general approach that these scientists bring to their work is called the scientific method. It is, quite simply, a common sense approach to developing an understanding of natural phenomena.

A scientific study normally begins with some observation that fires our curiosity and raises some questions about the behavior of nature. Usually, we begin to search for answers in the work of others who have published in scientific journals. As our knowledge grows, we begin to plan experiments that permit us to make our own observations. Generally, these experiments are performed in a laboratory under controlled conditions so the observations are *reproducible*. In fact, the ability to obtain the same results when experiments are repeated is what separates a true science from a pseudoscience such as astrology.

Empirical Facts and Scientific Laws

The observations we make in the course of performing our experiments provide us with empirical facts — so named because we learn them by *observing* some physical, chemical, or biological system. These facts are referred to as our data. For example, if we study the behavior of gases, such as the air we breathe, we soon discover that the volume of a gas depends on a number of factors, including the mass of the gas, its temperature, and its pressure. The bits of information we record relating these factors are our data.

One of the goals of science is to organize facts so that relationships or generalizations among the data can be established. For instance, one generalization we would make from our observations is that when the temperature of a gas rises, the gas tends to expand and occupy a larger volume. If we were to repeat our experiments many times with numerous different gases, we would find that this generalization is uniformly applicable to them all. Such a broad generalization, based on the results of many experiments, is called a law or scientific law.

Hypotheses and Theories

As useful as they may be in summarizing the results of experiments, laws can only state what happens. They do not explain *why* substances behave the way they do. Human beings are curious creatures, though, and we seek explanations. Therefore, after we've collected and studied our data we begin to speculate about the reasons for the results of our experiments. *The tentative explanation we formulate is called a* hypothesis. We use hypothesis to make predictions of new behavior and then design experiments to test our predictions. If the results of these new experiments prove us wrong, we must discard the hypothesis and seek a new one. However, if our explanation survives repeated testing, it is gradually accepted and may ultimately achieve the status of a theory. A theory *is a tested explanation of the behavior of nature*. Most useful theories are broad, with many far-reaching and subtle implications. It is impossible to perform every test that may show such a theory to be wrong, so we can never be *absolutely* sure the theory is correct.

The sequence of steps just described — observation, explanation, and the testing of an explanation by additional experiments — constitute the scientific method. Despite its name, this method is not used only by those who call themselves scientists. An auto mechanic follows the same steps when fixing your car. First, tests are performed (*observation*) that enable the mechanic to suggest the probable cause of the problem (*a hypothesis*). Then parts are replaced and the car is checked to see whether the problem has been solved (*testing of the hypothesis by experiment*). In short, we all use the scientific method as much by instinct as by design.

From the preceding discussion you may get the impression that scientific progress always proceeds in a dull, orderly, and stepwise fashion. This isn't true; science is exciting and provides a rewarding outlet for cleverness and creativity. Luck, *too*, *sometimes* plays an important role. For example, in 1828 Frederick Wöhler, a German chemist, was heating a substance called ammonium cyanate in an attempt to add support to one of his hypotheses. His experiment, however, produced an unexpected substance, which out of curiosity he analyzed and found to be urea (a constituent of urine). This was an exciting discovery, because it was the first time anyone has ever knowingly made a substance produced only by living creatures from a chemical not having a life origin. The fact that this could be done led to the beginning of a whole new branch of chemistry called *organic chemistry*. Yet, had it not been for Wöhler's curiosity and his application of the scientific method to his unexpected results, the significance of his experiment might have gone unnoticed.

As a final note, it is significant that the most spectacular and dramatic changes in science occur when major theories are proven wrong. This happens only rarely, but when it does occur, scientists are sent scrambling to develop new theories, and exciting new frontiers are opened.

(Selected from *Chemistry The Study of Matter and Its Changes* 2nd ed. J.E. Brady and J.R. Holum, John Wiley & Sons, Inc., New York, 1996)

Words and Expressions

sodium /'səudjəm/	*n*.	钠
chlorine /'klɔːriːn/	*n*.	氯
sodium hydroxide		氢氧化钠
lye /lai/	*n*.	碱液(水)
corrosive /kə'rəusiv/	*a*.	腐蚀(性)的
bleach /blitʃ; bliːtʃ/	*n*.	漂白剂
inhale /in'heil/	*v*.	吸气,吸入
ingestion /in'dʒestʃən/	*n*.	吸收,摄取,空气(气体,液体)的吸入
metabolize /mə'tæbəlaiz/	*v*.	使新陈代谢
photosynthesis /ˌfəutəu'sinθəsis/	*n*.	光合作用
combustion /kəm'bʌstʃən/	*n*.	燃烧
aerosol /'ɛərəsəl/	*n*.	喷雾剂
pseudoscience /'psjuːdəu'saiəns/	*n*.	假科学
astrology /ə'strɔlədʒi/	*n*.	占星术
empirical /im'pirikl/	*a*.	凭经验的,实证的
ammonium cyanate		氰酸铵
urea /'juəriə/	*n*.	尿素
urine /'juərin/	*n*.	尿