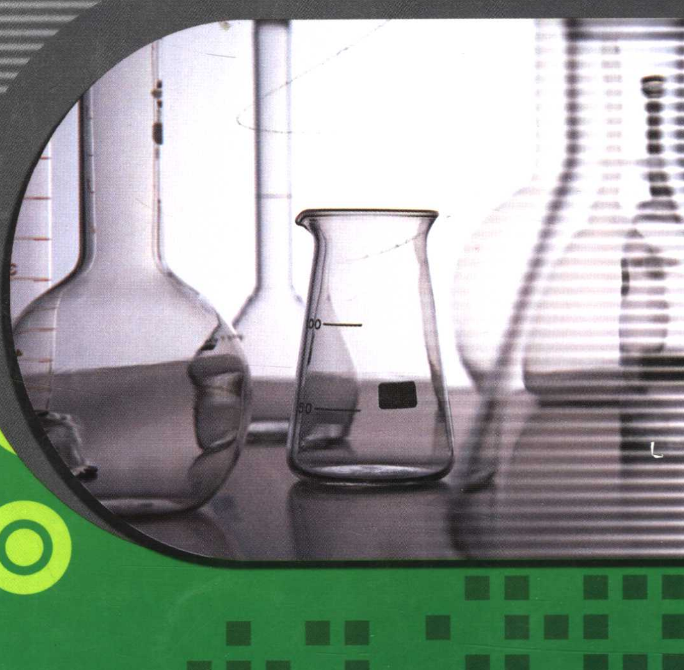
现代工程专业英语系列

应用化学化工专业英语

English for Science and Technology on Applied Chemistry and Chemical Engineering

主编◎丁慧贤 马晓燕 李成林



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内容简介

《应用化学化工专业英语》是根据《大学英语教学大纲》(理工科本科用)专业阅读部分的要求编写的,供理工科大学应用化学、化工工艺、环境工程等专业或相关专业的学生使用,也可供同等英语程度的相关专业的工程技术人员使用。

本书分六个单元,有化学基础知识(1~13课)、化学化工技术(14~16课)、表面活性剂与洗涤剂(17~24课)、环境工程(25~30课)、煤炭及综合利用(31~40课)、科技论文摘要。在编写过程中我们参阅了国内外大量有关资料,在保持原汁原味的基础上对文章中出现的科技术语、英语词组、语言难点及专业性知识都作了较为详细的注解。同时,对文章中出现的较难的句子也进行了翻译。对文章中出现的重要语法现象进行了分析。

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前言
PREFACE

“衣带渐宽终不悔，为伊消得人憔悴。”经过一年的努力，这本《应用化学化工专业英语》终于和广大读者见面了，本书是继大学基础英语之后为提高化学化工专业高年级学生、研究生和教师阅读化工英语原著的能力而编写的。化学化工英语具有丰富的词汇和句法结构，富有极强的表现力。它以其特有的深度和广度，忠实地反映了波澜壮阔的化工世界及其突飞猛进的前进步伐。随着现代科技的进步与发展，世界化学工业也发生了巨大的变化，在全球范围内，有关化学工业的书籍与杂志层出不穷、浩如烟海，而绝大多数的化学文献是用英语写成的。因此，化工英语既是传播信息的媒介，又是反映化工世界的镜子。“众里寻她千百度，蓦然回首，却在灯火阑珊处”我们编写此书的目的是为读者架设一座通向化工世界的桥梁，以帮助读者进一步提高英语的阅读水平和运用能力。

本书分六个单元，有化学基础知识（1～13 课）、化学化工技术（14～16 课）、表面活性剂与洗涤剂（17～24 课）、环境工程（25～30 课）、煤炭及综合利用（31～40 课）、科技论文摘要（41 课）。在编写过程中我们参阅了大量的国内外有关资料，在保持原汁原味的基础上对文章中出现的科技术语、英语词组、语言难点及专业性知识都作了较为详细的注解。同时，对文章中出现的较难的句子也进行了翻译。对文章中出现的重要语法现象进行了分析 。

本书集知识性、趣味性和实用性于一体，既可作为大学应用化学、化工工艺、环境工程等专业的专业英语教材，又可作为教师参考书目及广大科技人员自修英语、拓宽科学视野的指导性读物。

由于编者水平有限，书中难免会有疏漏之处，诚请广大读者不吝赐教。

编者

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Unit 1　General Knowledge of Chemistry

Lesson 1　History of Chemistry

Primitive man found out by trial and error how to carry out a certain number of simple chemical changes, but under the ancient Egyptian civilization men learned how to work copper, tin, iron and precious metals; knew how to make pottery, glass, soap and colouring agents, and how to bleach and dye textile fabrics. These arts were the beginnings of the chemical industries of today.

The early scientific study of chemistry, known as alchemy, grew up in the first few centuries A. D. at Alexandria in Egypt. There two important things came together: one was the practical knowledge of the Egyptian workers in metals, pottery and dyes; the other was the learning of the earlier Greek philosophers, such as Hippocrates and Aristotle. At the same time alchemy was much influenced by ideas from the East about magic and astrology—foretelling the future from the stars.

Greek Philosophers regarded debate about the nature of matter as superior to experiment(1), and some held that all matter was made up of the same four "elements" — earth, fire, air and water. Many people therefore thought that if these elements could be rearranged, one substance could be changed into another. For instance, a base metal(2) could perhaps be turned into gold. The chief aim of the alchemists was to find a way doing this.

Alchemy came under Arab influence when the armies of Islam conquered Egypt during the seventh century. The Arabs carried its study into western Europe when they advanced into Spain. Many Arabic words are still used in chemistry — "alkali", "alcohol" and even "alchemy" itself, which means "the art of Egypt". The greatest Arab alchemist was Jabir ibn Hayyan(3), possibly the same person as Geber(4), author of two important books on alchemy known from the Latin translations of the thirteenth century. Jabir claimed that mercury and sulphur were "elements" like the four Greek ones. He said that all metals were composed of mercury and sulphur in different proportions. To change a base metal into gold required the proportions to be changed by the action of a mysterious substance which came to be called "the philosopher's stone(5)": Alchemists searched in vain for this substance for several hundred years.

Alchemy was studied widely in Europe during the twelfth and following centuries, and attracted the attention of many learned men. Though they were doomed to fail in their attempts to made gold, their work led to the growth of a great deal of new chemical knowledge and of methods of making experiments. Many of the later European alchemists, however, were complete frauds who preyed upon trusting people by all sorts of tricks, and the subject fell into disrepute(6). By the first half of the sixteenth century, the aim of the alchemists had changed from the making of gold to the making of medicines. In particular they sought a fanciful substance called "the elixir of life", a powerful medicine which was to cure all ills, and which some people thought would turn out to be the same substance as "the philosopher's stone". This phase of chemistry lasted till about 1700.

New Words

1. Egyptian [iˈdʒipʃən] *adj. &n.* 埃及的;埃及人;埃及语
2. bleach [bliːtʃ] *vt. &vi.* 漂白,变白
3. textile [ˈtekstail] *n. &adj.* 纺织品;纺织的
4. alchemy [ˈælkimi] *n.* 炼金术
5. astrology [əˈstrɔlədʒi] *n.* 星相学,占星术
6. alchemist [ˈælkimist] *n.* 炼金术士
7. Islam [ˈizlɑːm] *n.* 伊斯兰(教,国家),回教
8. disrepute [ˈdisriˈpjuːt] *n.* 坏名声

Notes

(1) …regarded debate about the nature of matter as superior to experiment: ……认为对物质本质的辩论胜过实验。

句中 regard …as …译为"把… 看作";"将…认为"。

(2) base metal:贱金属(一般指铁、铅等)

(3) Jabir ibn Hayyan:(人名)阿拉伯化学之父(大约在 8 世纪)

(4) possibly the same person as Geber:(他)可能就是 Geber.

(5) the philosopher's stone: 点金石(炼金术士所寻求的,能使其他金属变成金银的一种实际上不存在的东西)。

(6) fell into disrepute :声名狼藉。

Exercises

1. Put the following into Chinese

be doomed to fail, in vain, came under Arab influence,
colouring agent, the elixir of life

2. Reading Comprehension

(1) Alchemy was originated in ______.

A. the East. B. Spain. C. England. D. Alexandria

(2) The early alchemists thought that ______.

A. stone could be changed into a base metal

B. a base metal could be turned into glass

C. gold could be changed into stone

D. a base metal could be changed into gold

(3) According to this passage, "the elixir of life" was ______.

A. the philosopher's stone B. a base metal

C. a cure-all. D. alcohol

(4) Jabir ibn Hayyan ______.

A. wrote two books on alchemy in the thirteenth century

B. was a translator of alchemy books

C. extended the Greek theories about the "elements"

D. discovered the "philosopher's stone"

(5) Before the sixteenth century, alchemy ______.

A. became more important

B. had a bad reputation

C. was successfully carried out

D. was studied by every philosopher.

Lesson 2 Chemistry and Society

For the first two-thirds of the 20th century, chemistry was seen by many as the science of the future. The potential of chemical products for enriching society appeared to be unlimited. Increasingly, however, and especially in the public mind, the negative aspects of chemistry have come to the fore. Disposal of chemical by-products(1) at waste-disposal sites of limited capacity has resulted in environmental and health problems of enormous concern. The legitimate use of drugs for the medically supervised treatment of diseases has been tainted by the growing misuse of mood-altering drugs. The very word chemicals has come to be used all too frequently in a pejorative sense. There is, as a result, a danger that the pursuit and application of chemical knowledge may be seen as bearing risks that outweigh the benefits.

It is easy to underestimate the central role of chemistry in modern society, but chemical products are essential if the world's population is to be clothed, housed, and fed. The world's reserves of fossil fuels (e.g., oil, natural gas, and coal) will eventually be exhausted, some as soon as the 21st century, and new chemical processes and materials will provide a crucial alternative energy source. The conversion of solar energy to more concentrated, useful forms, for example, will rely heavily on discoveries in chemistry. Long-term, environmentally acceptable solutions to pollution problems are not attainable without chemical knowledge. There is much truth in the aphorism that "chemical problems require chemical solutions". Chemical inquiry will lead to a better understanding of the behaviour of both natural and synthetic materials and to the discovery of new substances that will help future generations better supply their needs and deal with their problems.

Progress in chemistry can no longer be measured only in terms of economics and utility. The discovery and manufacture of new chemical goods must continue to be economically feasible but must be environmentally acceptable as well. The impact of new substances on the environment can now be assessed before large-scale production begins, and environmental compatibility has become a valued property of new materials. For example, compounds consisting of carbon fully bonded chlorine and fluorine, called chlorofluorocarbons (or Freons), were believed to be ideal for their intended use when they were first discovered. They are nontoxic, nonflammable gases and volatile liquids that are very stable. These properties led to their widespread use as solvents, refrigerants, and propellants in aerosol containers. Time has shown, however, that these compounds decompose in the upper regions of the atmosphere and that the decomposition products act to destroy stratospheric ozone. Limits have now been placed on the use of chlorofluorocarbons, but it is impossible to recover the amounts already dispersed into the atmosphere.

The chlorofluorocarbon problem illustrates how difficult it is to anticipate the overall impact that new materials can have on the environment. Chemists are working to develop methods of assessment, and prevailing chemical theory provides the working tools. Once a substance has been identified as hazardous to the existing ecological balance, it is the responsibility of chemists to locate that substance and neutralize it, limiting the damage it can do or removing it from the environment entirely. The last years of the 20th century will see many new, exciting discoveries in the processes and products of chemistry. Inevitably, the harmful effects of some substances will outweigh their benefits, and their use will have to be limited. Yet, the positive impact of chemistry on society as whole seems beyond doubt.

New Words

1. come to the fore 出名;崭露头角
2. underestimate [ˌʌndəˈrestimeit] *vt.* 低估;看轻;*n.* 低估
3. fossil fuel 矿物燃料
4. aphorism [ˈæfərizm] *n.* 格言,警语,谚语
5. chlorofluorocarbons *n.* 氟利昂
6. nontoxic [nɔnˈtɔksik] *adj.* 无毒的
7. nonflammable [nɔnˈflæməbl] *adj.* 不燃烧的
8. propellant [prəˈpelənt] *adj.* 推进的;*n.* 火药;喷气燃料;推进燃料;压缩到瓶中气体
9. aerosol [ˈɛərəsɔl] *n.* 气溶胶;气雾剂;烟雾剂
10. ozone [ˈəuzəun] *n.* 新鲜的空气;臭氧
11. ecological balance 生态平衡

Notes

(1) by-products 副产品

这是科技英语的一种构词法——合成法。

由两个或更多的词合成一个词叫合成法。有时需加连字符。如:

副词+过去分词	well-known	著名的
名词+名词	carbon steel	碳钢
名词+过去分词	computer-oriented	研制计算机的
动词+副词	check-up	检查
形容词+名词	atomic weight	原子量
动词+代词+副词	pick-me-up	兴奋剂

另外,科技英语中还普遍采用压缩法、混成法、符号法和字母象形法等构词方法。

Exercises

1. Put the following into Chinese

(1)(Shortening);EST EPT TOEFL CEF CAD

(2)(Blending);smog mote positron modem

(3)(Letter Symbolizing);I-bar T-square U-pipe X-ray
I-steel N-region T-beam T-connection

Lesson 3 Chemistry and Chemical Engineering

1. What is Chemistry about

The different kinds of matter that compose the universe are termed materials. Each material has its own distinguishing characteristics, which is termed its properties. These properties enable the material to be recognized or separated from other materials.

The study of materials is the joint concern of chemistry and physics. These two sciences are so closely related that no one can learn very much about either without considerable training in the other. In many of their applications it is hard to tell where the one science leaves off and the other begins.

Roughly stated, physics is concerned with the general properties and energy and with events which results in what are termed physical changes. Physical changes are those in which materials are not so thoroughly altered as to be converted into other materials distinct from those present at the beginning.

Chemistry, by contrast, is chiefly concerned with properties that distinguish materials from one another and with events which result in chemical changes. Chemical changes are those in which materials are transformed into completely different materials. Who but a chemist would ever guess that common salt can be resolved into a greenish gas and silvery metal? Or that two odorless gases, nitrogen and hydrogen, can be combined to form ammonia? Or that ordinary air and water can be converted into nitric acid? Or that coal tar contains ingredients that can be transformed into dyestuffs and perfumes?

Such thoroughgoing transformations, in which all the properties of a material are altered, so that a completely different material is obtained, are called chemical transformations, chemical changes or chemical reactions.

Chemistry as an art is concerned with identifying, separating and transforming materials, in applying them to definite uses.

Chemistry as a science is a manner of thinking about transformations of materials which helps us to understand, predict and control them. It furnishes directing intelligence in the use of materials.

2. The Scope of Chemistry

Chemistry is sometimes called the "central science" because it relates to so many areas of human endeavor and curiosity, Chemists who develop new materials to improve electronic devices such as solar cells, transistors, and fiber optic cables work at the interfaces of chemistry with physics and engineering. Those who develop new pharmaceuticals for use against cancer or AIDS work at the interfaces of chemistry with pharmacology and medicine.

Many chemists work in more traditional fields of chemistry. Biochemists are interested in chemical processes that occur in living organisms. Physical chemists work with fundamental principles of physics and chemistry in an attempt to answer the basic questions that apply to all of chemistry: Why do some substances react with one another while others do not? How fast will a particular chemical reaction occur? How much useful energy can be extracted from a chemical reaction? Analytical chemists are investigators; they study ways to separate and identify chemical substances. Many of the techniques developed by analytical chemists are used extensively by environmental scientists. Organic chemists focus their attention on substances that contain carbon and hydrogen in combination with a few other elements. The vast majority of substances are organic chemicals. Inorganic chemists focus on most of the elements other than carbon, though the fields of organic and inorganic chemistry overlap in some ways.

Although chemistry is considered a "mature" science, the landscape of chemistry is dotted with unanswered questions and challenges. Modern technology demands new materials with unusual properties, and chemists must devise new methods of producing these materials. Modern medicine requires drugs targeted to perform specific tasks in the human body, and chemists must design strategies to synthesize these drugs from simple starting materials. Society requires improved methods of pollution control, substitutes for scarce materials, nonhazardous means of disposing of toxic wastes, and more efficient ways to extract energy from fuels. Chemists are at work in all these areas.

3. Chemical Engineering

Chemical engineering is the profession concerned with the creative application of the scientific principles underlying the transport of mass, energy and momentum, and the physical and chemical change of matter. The broad implications of this definition have been justified over the past few decades by the kinds of problems that chemical engineers have solved, though the profession has devoted its attention in the main to the chemical process industries. As a result chemical engineers have been defined more traditionally as those applied scientists trained to deal with the research, development, design and operation problems of the chemicals, petroleum and related industries. Experience has shown that the principles required to meet the needs of the process industries are applicable to a significantly wider class of problems, and the modern chemical engineer is bringing his established tools to bear on such new areas as the environmental and life sciences.

Chemical engineering developed as a distinct discipline during the twentieth century in answer to the needs of a chemical industry no longer able to operate efficiently with manufacturing processes which in many cases were simply larger scale versions of laboratory equipment. Thus, the primary emphasis in the profession was initially devoted to the general subject of how to use the results of laboratory experiments to design process equipment capable of meeting industrial production rates. This led naturally to the characterization of design procedures in terms of the unit operations, those elements common to many different processes. The basic unit operations include fluid flow, heat exchange, distillation, extraction, etc. A typical manufacturing process will be made up of combinations of the unit operations. Hence, skill in designing each of the units at a production scale would provide the means of designing the entire process.

The unit operations concept dominated chemical engineering education and practice until the mid- 1950s, when a movement away from this equipment-oriented philosophy toward and engineering science approach began. This approach holds that the unifying concept is not specific processing operations, but rather the understanding of the fundamental phenomena of mass, energy and momentum transport that are common to all of the unit operations, and it is argued that concentration on unit operations obscures the similarity of many operations at a fundamental level.

Although there is no real conflict between the goals of the unit operations and engineering science approaches, the latter has tended to emphasize mathematical skills and to de-emphasize the design aspects of engineering education. Such a conflict need not exist, and recent educational effort has been directed toward the development of the skills that will enable the creative engineering use of the fundamentals, or a synthesis of the engineering science and unit operations approaches. One essential skill in reaching this goal is the ability to express engineering problems meaningfully in precise quantitative terms. Only in this way can the chemical engineer correctly formulate, interpret, and use fundamental experiments and physical principles in real world applications outside of the laboratory. This skill which is distinct from ability in mathematics, we call analysis.

New Words

1. greenish [ˈgriːniʃ] *a.* 呈绿色的
2. nitrogen [ˈnaitridʒən] *n.* 氮
3. ammonia [æˈməunjə] *n.* 氨水,阿摩尼亚
4. nitric [ˈnaitrik] *a.* 氮的,含氮的;硝石的
5. ingredient [inˈgriːdiənt] *n.* 成分,因素
6. dyestuff [ˈdaistʌf] *n.* 染料
7. perfume [ˈpəːfjuːm] *n. &vt.* 香水,香气,洒香水于;薰香
8. endeavor [inˈdevə] *n.* 努力,尽力,竭力,力图,试图
9. curiosity [ˌkjuəriˈɔsiti] *n.* 好奇心;新奇的事物,珍品
10. pharmacology[ˌfɑːməˈkɔlədʒi] *a.* 配药学的
11. toxic [ˈtɔksik] *a.* 有毒的;中毒的
12. distillation [ˌdistiˈleiʃən] *n.* 蒸馏

Exercises

1. Put the following into English.

物理化学　化学反应　无味气体　硝酸　太阳能　光纤

2. Translate the following reading materials into Chinese.

Reading Material

Chemistry

The science that deals with the properties, composition, and structures (defined as elements and compounds), the transformations they undergo, and the energy that is released or absorbed during these processes. Every substance, whether naturally occurring or artificially produced, consists of one or more of the hundred-odd species of atoms that have been identified as elements. Although these atoms, in turn, are composed of more elementary particles, they are the basic building blocks of chemical substances; there is no quantity of oxygen, mercury, or gold, for example, smaller than an atom of that substance. Chemistry, therefore is concerned not with the subatomic domain but with the properties of atoms and the laws governing their combinations and how the knowledge of these properties can be used to achieve specific purposes.

The great challenge in chemistry is the development of a coherent explanation of the complex behaviour of materials, why they appear as they do, what gives them their enduring properties, and how interactions among different substances can bring about the formation of new substances and the destruction of old ones. From the earliest attempts to understand the material world in rational terms, chemists have struggled to develop theories of matter that satisfactorily explain both permanence and change. The ordered assembly of indestructible atoms into small and large molecules, or extended networks of intermingled atoms, is generally accepted as the basis of permanence, while the reorganization of atoms or molecules into different arrangements lies behind theories of change. Thus chemistry involves the study of the atomic composition and structural architecture of substances, as well as the varied interactions among substances that can lead to sudden, often violent reactions.

Chemistry also is concerned with the utilization of natural substances and the creation artificial ones. Cooking, fermentation, glass making, and metallurgy are all chemical processes that date from the beginnings of civilization. Today, vinyl, Teflon liquid crystals, semiconductors and superconductors represent the fruits of chemical technology. The 20th century has seen dramatic advances in the comprehension of the marvelous and complex chemistry of living organisms, and a molecular interpretation of health and disease holds great promise modern chemistry, aided by increasingly sophisticated instruments, studies materials as small as single atoms and as large and complex as DNA (deoxyribonucleic acid), which contains millions of atoms. New substances can even be designed to bear desired characteristics and then synthesized. The rate at which chemical knowledge continues to accumulate is remarkable. Over time more than 8 000 000 different chemical substances, both natural and artificial, have been characterized and produced. The number was less than 500 000 as recently as 1965.

Intimately interconnected with the intellectual challenges of chemistry are those associated with industry. In the mid-19th century the German chemist Justus Von Liebig commented that the wealth of a nation could be gauged by the amount of sulfuric acid it produced. This acid, essential to many manufacturing processes, remains today the leading chemical product of industrialized countries. As Liebig recognized, a country that produces large amounts of sulfuric acid is one with a strong chemical industry and a strong economy as a whole. The production, distribution, and utilization of a wide range of chemical products is common to all highly developed nations. In fact, one can say that the "iron age" of civilization is being replaced by a "polymer age," for in some countries the total volume of polymers now produced exceeds that of iron.

The Scope of Chemistry

The days are long past when one person could hope to have a detailed knowledge of all areas of chemistry. Those pursuing their interests into specific areas of chemistry communicate with others who share the same interests. Over time a group of chemists with specialized research interests become the founding members of area of specialization. The areas of specialization that emerged early in the history of chemistry, such as organic, inorganic, physical, analytical and industrial chemistry, along with biochemistry, remain of greatest general interest. There has been, however, much growth in the areas of polymer environmented and medicinal chemistry, during the 20th century. Moreover, new specialities continue to appear, as, for example, pesticide, forensic, and computer chemistry.

Lesson 4 Elements

Elements are pure substances that cannot be decomposed into simpler substances by ordinary chemical changes. At the present time there are 106 known elements. Element 106 is man-made and as yet unnamed. Some common elements that are familiar to(1) you are carbon, oxygen, aluminum, iron, copper, nitrogen, and gold. The elements are the building blocks of matter just as the numerals 0 through 9 are the building blocks for numbers. To the best of our knowledge, the elements that have been found on the earth also comprise the entire universe.

About 85% of the elements can be found in nature, usually combined with other elements in minerals and vegetable matter or in substances like water and carbon dioxide. Copper, silver, gold, and about 20 other elements can be found in highly pure forms. Sixteen elements are not found in nature; they have been produced in generally small amounts in nuclear explosions and nuclear research. They are man-made elements.

Nearly 99% of the earth's crust is made up of only eight of the 106 elements. The human body is composed primarily of only six elements. Oxygen is the predominant element in each(2).

The names of many of the elements are derived from Latin or Greek terms that usually describe one of their properties. Chlorine comes from the Greek "chloros", which means "greenish yellow", The color of chlorine gas. Phosphorus comes from the Greek "phosphoros", meaning "light bearing"(3), for its "glow in the dark" property. Other elements are named after people or places such as einsteinium (for Albert Einstein), curium (for Madame Curie).

Just as symbols and abbreviations are widely used in medical areas to simplify communication chemists use symbols to represent the name of the elements. Each element has a different symbol made of one or two letters. If one letter is used, as it is for 13 of the elements, it is written as a capital: oxygen, O; nitrogen, N. if two letter are used, only the first is capitalized: calcium, Ca; aluminum, Al. The symbols are more than just abbreviations(4) since they also stand for certain amounts of the element. The symbol H means not only hydrogen, but one atom of hydrogen.

Most symbols suggest the name of the element they represent, while others seem unrelated to their English names. The symbols for this latter class of elements are derived from their early names (often Latin), which were widely used in the past.

Table 4 - 1

Elemental Compostition by weigh(%)			
The Earth's Crust		The Average Human Body	
oxygen	46.60	oxygen	65.0
silicon	27.72	carbon	8.0
aluminum	8.3	hydrogen	10.0
iron	5.00	nitrogen	3.0