应用技术大学系列教材

科技英语

COLLEGE ENGLISH FOR SCIENCE AND TECHNOLOGY

张少文　王　强　主编

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前言

本书是按教育部《大学英语专业阅读阶段教学基本要求》编写而成，主要供高等学校化学、环境、生物类专业的英语阅读教学使用，也可供其他相关专业教学时选用。

为适应普通高校向应用技术型转型发展的需要，本书通过选取不同题材英语原文，突出了专业性和应用性内容。通过学习，使学生熟悉科技文体、增加科技词汇量，培养学生的专业阅读理解和语言分析能力，帮助学生实现大学基础英语学习向专业文献阅读理解过渡，实现外语学习最终服务于专业学习、应用与发展的目标。科技英语专业性强、词汇丰富、语法结构和语言表达方式较为独特，学习科技英语是对大学英语的补充和提高，也是学生开阔视野，了解专业领域国际前沿和发展趋势的基本途径。

本书选材广泛，内容新颖，既侧重于专业性基础英语的学习，又兼顾现代科技知识，内容涵盖了环境、化学、生物和新材料等方面的内容。课文难易适当，行文流畅，语言生动，结构严谨。课文后面配有专业性词汇、词组的解释和关键性句子的注解，便于学生自学。

本次修订对原书部分文章进行了调整，并对存在的问题进行了勘正。全书仍选用 16 篇课文，可根据教学时间和专业特点选取不同的内容。每课均附有阅读材料，可供学生课余练习用，不做教学要求。

参加本书编写工作的有张少文（1~7 课）、周国强（8~9 课）、王强（10~16 课、附录），全书由张少文统一整理定稿。

本书编写过程中借鉴了英美科技期刊和网站上的论文、部分高等院校专业英语教材中的许多有益内容。中国环境出版社为本书的出版给予了大力支持，在此一并致谢。

由于编者经验和水平有限，书中不妥之处在所难免，敬请批评指正。

编 者

2014 年 7 月

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Unit 1

Air Fit to Breathe

Imagine that some extraordinarily powerful astronomical instrument were to be invented that allowed us to see the planets that must surely orbit around other stars, and to look at the composition of their atmospheres. Were we to come across one with an atmosphere like our own, we could scarcely conclude other than that here was a planet on which life had evolved. Not could evolve, but most definitely had. Our atmosphere is a beacon broadcasting our presence to any intelligent beings who might be able to see it.

The reason for this is that, unlike those of the other planets in the Solar system, Earth's atmosphere is in a state of extreme chemical disequilibrium①. It is in some sense comparable to a mixture of compounds in a vast beaker that is being maintained in a state far from equilibrium-indeed, rather like those chemical systems we encountered. What is holding the atmosphere away from chemical equilibrium? Ultimately it is the energy of the Sun, as well as heat from the Earth's interior. But the principal agent that converts this energy into chemical disequilibrium is life itself.

This is to say that it would be quite wrong to view our environment as one miraculously tuned to our needs. It is no coincidence that the atmosphere is suited to the organisms that dwell within and beneath it, for the evolution of life and the attainment of the atmosphere's present composition have not been independent processes.

About 4,600 million years ago, the newly formed Earth was a ball of molten magma which had been condensed, along with the Sun and the other planets, out of a primordial gaseous nebula. Within the body of this molten Earth, chemical elements began to separate out. Much of the planet consisted of iron, which sank (together with a smaller amount of nickel) to form a metal core, leaving behind a "scum" of molten rock which contained largely magnesium, silicon, oxygen, some remaining iron, aluminum, sodium, potassium and calcium. This chemical "differentiation" of the Earth is similar to the process that occurs in an iron smelter during extraction of iron from its ores.

About 3,900 million years ago, much of the planet's heat had been radiated out to space, and the surface was cool enough to solidify into a thin, rocky crust. Two processes now began to contribute to the formation of an atmosphere. The molten rock below the crust contained many dissolved gases, such as water, methane, carbon oxides, nitrogen and neon. These were released from the magma through volcanoes that punctured the solid crust, in a process called degassing. Meanwhile, stray bodies in the Solar System left over from the formation of the planets occasionally collided with the Earth, releasing considerable quantities of volatile gases. It has been suggested that as much as 85 per cent of the water presently on Earth was brought here by impacting extraterrestrial objects.

About 3,800 million years ago, the temperature at the Earth's surface fell below 100 degrees Celsius, at which point water vapor in the atmosphere could be condensed to liquid. It is hard to picture the rainstorm that ensued: imagine, if you can, the entire contents of the oceans falling from the skies in a deluge lasting for perhaps 100,000 years. With the appearance of the oceans, gases that dissolve to a significant extent in water, such as hydrogen chloride, sulfur dioxide and carbon dioxide, were extracted from the atmosphere into the water. Reactions with minerals would then have precipitated some of these compounds as insoluble salts, such as carbonates and sulfates[②].

Light gases such as hydrogen, helium and neon, which were abundant in the solar nebula, are too light to be retained by the Earth's gravity, and so they simply rose through the atmosphere and evaporated away into space. Left behind in the early atmosphere were gases such as methane, water vapor, nitrous oxide (N_2O) and carbon monoxide (CO). It was under skies such as these, that life first appeared.

It is remarkable that the complex chemistry of life may have developed from its raw materials within the space of just 300 million years. Yet this is the implication of the discovery in 1983 by S.M.Awramik and colleagues of 3,500-million-year-old rocks in Western Australia that contained evidence of the fossilized forms of bacteria. These organisms appeared to be very similar to some of the very primitive species that still exist today, called blue-green algae or cyanobacteria.

But whereas most algae today obtain their energy by splitting water molecules through photosynthesis, the metabolism of the earliest organisms probably involved many cruder chemical reactions such as those utilized by archaebacteria, the most primitive form of life is still extant today[③]. Some of these organisms split apart organic molecules such as acetic acid, releasing energy and forming carbon dioxide and methane in the process. Others convert carbon dioxide to methane, or sulfate ions to hydrogen sulfide.

These resourceful bacteria were quite contently living under oxygen-free skies; in fact, oxygen was poisonous to them. But we must assume that one day a species of bacteria made the discovery that the stuff all around them–water–could itself provide a bountiful source of energy when split apart. This was a profoundly antisocial habit, because it yielded as a by-product the toxic gas oxygen. Lynn Margulis, a microbiologist from Harvard University, has described the appearance of photosynthesizing organisms as having heralded a "worldwide pollution crisis" of such magnitude that our present-day industrial emissions are as nothing in comparison. The evolution of life changed the atmosphere beyond recognition.

The time at which this crisis truly took a grip on the planet is open to some debate, but most researchers now place it at around 1,900 to 2,000 million years ago. Oxygen production eventually became overwhelming, presumably because the benefits of using photosynthesis as an energy source were so substantial that bacteria with this capability simply took over, until oxygen was bubbling forth from colonies of algae throughout the world. Inevitably, this polluting activity led to the extinction of many microbial populations, but at the same time mutant strains evolved that was resistant to the poison. Some of these showed still greater adaptability: rather than stoically tolerating the unhealthy new environment, they found a way to thrive in it. The metabolic pathways of these organisms developed so as to actually utilize the oxygen in the atmosphere. They learned to breathe the air of the new world.

These single-celled oxygen-breathing organisms, called protozoa, were the first animals. They made their appearance about 800 million years ago, when the concentration of oxygen in the atmosphere had reached about 5 per cent of its present-day value. Oxygen has probably been maintained at its present proportion of about one-fifth of the atmosphere more or less steadily during at least the past 300 million years, although before this there is evidence of substantial fluctuations: at one time as much as 35 per cent of the air may have been oxygen.

In the upper atmosphere, sunlight splits apart oxygen molecules into their two constituent atoms, and these undergo subsequent reactions with other O_2 molecules to form a new type of oxygen compound containing three atoms: ozone (O_3). This molecule absorbs ultraviolet light strongly, and so filters this part of the spectrum out of the sunlight impinging on the atmosphere. As ultraviolet light is damaging to organic matter, it was not until the ozone layer had formed, about 400 million years ago, that living creatures could entertain the notion of leaving the protecting blanket of seawater and venturing onto dry land.

Phrases and Expressions

1. astronomical [æstrə'nɔmɪk(ə)l] *adj.* 天文学的，庞大无法估计的
2. beacon ['bi:kən] *n.* 灯塔，航标
3. magma ['mægmə] *n.*（有机物或矿物的）稀糊状混合物；岩浆
4. primordial [prai'mɔ:djəl] *adj.* 原始的，最初的
5. nebula ['nebjulə] *n.* 星云
6. scum [skʌm] *n.* 渣滓，糟粕
7. puncture ['pʌŋktʃə] *n.* 刺穿，穿孔
8. extraterrestrial [ˌekstrətə'restriəl] *adj.* 宇宙的，地球大气圈外的
9. primitive ['primitiv] *adj.* 初期的，原始的，原生的，基本的
10. algae ['ældʒi:] *n.* 藻，藻类
11. cyanobacteria [ˌsaiənəʊbæk'tiəriə] *n.* 蓝藻细菌
12. archaebacteria [ˌɑ:kibæk'tiəriə] *n.* 原始细菌
13. stuff [stʌf] *n.* 原料，要素
14. microbiologist [maikrəʊbai'ɔlədʒist] *n.* 微生物学家
15. photosynthesize [ˌfəutəu'sinθisaiz] *vi.*（植物等）进行光合作用，实行光能合成
    vt.（通过）光合（作用）产生
16. mutant ['mju:tənt] *adj.* 变异的，突变的
17. strain [strein] *n.* 株，种，品系
18. protozoa [prəutəu'zəuə] *n.* 杀原生动物药；*n.* 原生动物
19. venture ['ventʃə] *v.* 冒……的危险，冒昧，斗胆

Notes to the text

1. The reason for this is that, unlike those of the other planets in the Solar system, Earth's atmosphere is in a state of extreme chemical disequilibrium.

原因是这样的，和太阳系的其他星球不同，地球大气层处在一个极端的化学不平衡状态。

2. With the appearance of the oceans, gases that dissolve to a significant extent in

water, such as hydrogen chloride, sulfur dioxide and carbon dioxide, were extracted from the atmosphere into the water. Reactions with minerals would then have precipitated some of these compounds as insoluble salts, such as carbonates and sulfates.

随着海洋的出现，在水中溶解的来自于大气的如氯化氢、二氧化硫、二氧化碳的气体也达到了足以产生影响的程度，它们（水中溶解的气体物质）与矿物质反应可能就会沉淀出一些如碳酸盐和硫酸盐形式的不溶盐。

3. But whereas most algae today obtain their energy by splitting water molecules through photosynthesis, the metabolism of the earliest organisms probably involved many cruder chemical reactions such as those utilized by archaebacteria, the most primitive form of life still extant today.

但是尽管大多数今天的藻类是通过光合作用来分解水分子获得它们所需能量，最早的有机体的新陈代谢可能涉及更多原始的化学反应，如原始细菌、现今依然存在的生命最原始形态所利用的反应。

【Reading material】

Recycling the World

Today's air has an oxygen content of about 21 per cent; most of the remaining 79 per cent consists of the unreactive gas nitrogen. About 0.05 per cent is carbon dioxide, sufficient to support plant growth. This composition is regulated both by the sum of all lives on Earth—the biosphere—and by geological processes involving the land masses, the oceans and the planet's interior, which collectively comprise the geosphere. The biosphere encompasses all living things: the forests and grasslands, the microbes in soil and the communities of the seas: phytoplankton and zooplankton, microscopic marine plants and animals respectively. Photosynthesizers (which is to say, plants) strip water of its hydrogen atoms and use them to convert carbon dioxide to energy-rich carbohydrates, releasing oxygen gas in the process. Consumers (that is, animals) breathe in oxygen and use it to burn up ingested carbohydrates, converting carbon compounds back to carbon dioxide, which is released into the air again. This process, known as respiration, releases energy which the consumers generally store for later use in the form of the compound ATP. Without photosynthesizers to regenerate the oxygen used up by consumers, the atmosphere's oxygen content would slowly but steadily decline.

Much of the carbon "fixed" into organic matter by photosynthesizers is eventually released back into the atmosphere as carbon dioxide via respiration of consumers (primarily that of the microbes which decompose dead plant matter). But carbon is also cycled to and from the atmosphere via purely "inorganic" geochemical processes①. The reaction between atmospheric CO_2 and minerals (known as weathering) binds up the carbon in carbonate compounds, while transformation ("metamorphism") of carbonate-rich rocks, perhaps induced by the deformations caused by collision of tectonic plates, can release CO_2. Carbon dioxide dissolves in the oceans to form soluble species such as bicarbonate ions. And carbon-rich sediments on the seafloor—the remains of dead organisms from the upper waters-are dragged down into the Earth's interior when a tectonic plate plunges down under another at ocean trenches. The carbon is converted into new forms by the heat within the Earth's mantle, and is recycled into the atmosphere in the effluent of volcanoes which sit behind the ocean trench.

Nitrogen, too, is cycled to and from the atmosphere by processes involving the biosphere and geosphere. Certain kinds of bacteria transform the normally very unreactive nitrogen molecules to ammonia, whence it is converted into nitrogen-containing organic compounds such as amino acids. All organisms require amino acids; plants synthesize theirs directly, but animals obtain them from ingested matter-either plant tissue or that of other animals. The nitrogen in organic compounds is ultimately converted back to inorganic forms. Some may be incorporated into urea and then into ammonia again; some is "oxidized", to nitrite (NO_2^-) and nitrate (NO_3^-)ions. In a process known as denitrifiacation, bacteria strip nitrate ions of their oxygen atoms, releasing nitrogen gas back into the atmosphere.

These cyclic transformations of oxygen, carbon and nitrogen through the atmosphere, biosphere and geosphere are known as biogeochemical cycles②. A wonderful account of a carbon atom's journey through parts of this cycle can be found in Primo Levi's *The periodic Table.* When processes that remove elements from the atmosphere are balanced by those that replenish them, the atmosphere remains in a "steady state"—never achieving thermodynamic equilibrium, yet always staying the same.

We saw that the behavior of systems that are out of equilibrium can be hard to predict-in particular, they can undergo large changes in response to small disturbances. We do not know how stable the present steady state of the atmosphere is, but we do know that there were times early in the planet's history when it was in entirely different steady state, with a different composition.

Phrases and Expressions

1. biosphere ['baiəsfiə] *n.* 生物圈，生命层
2. phytoplankton [ˌfaitəu'plæŋktən] *n.* 浮游植物
3. zooplankton [ˌzəuə'plæŋktən] *n.* 浮游动物
4. metamorphism [ˌmetə'mɔ:fizəm] *n.*（岩石）变质作用
5. tectonic plate 地壳构造板块
6. bicarbonate ion 重碳酸离子
7. sediment ['sedimənt] *n.* 沉积物
8. mantle ['mæntl] *n.* 地幔
9. biogeochemical cycles 生物地球化学循环

Notes to the text

1. But carbon is also cycled to and from the atmosphere via purely "inorganic" geochemical processes.

但是碳也会通过完全的“无机”地球化学过程和大气进行往复循环。

2. These cyclic transformations of oxygen, carbon and nitrogen through the atmosphere, biosphere and geosphere are known as biogeochemical cycles.

这些氧、碳、氮通过大气、生物圈、地圈的循环变换统称为生物地球化学循环。

Unit 2

Glass: On the Cutting Edge①

Remarkable adaptations of this ancient material promise better computers, telescopes and buildings..

The most reliable research places the discovery of glass as far back as 2500 B.C. in Mesopotamia (present-day Iraq and Syria) and in Egypt. Ever since, glass has been of noble service to humans.

The uses of glass have been broadened dramatically by new technologies: glass fiber optics carry telephone and TV signals across the nation; glass ceramics serve as the nose cones of missiles and as crowns for teeth; glass is even fashioned of nuclear waste and buried deep underground.

"Glass has so many unique properties - its ease of shaping, its transparency, durability and low cost - that it will be indispensable in the growing communications, information and electronics industries," says William R. Prindle, a former vice-president of the Technology group at Corning Incorporated, in Corning, N.Y. The surge in fiber-optic use and in liquid-crystal displays has set the U.S. glass industry to building new plants to meet demand. Manufacturing sales figures in 1991 for the U.S. glass industry totalled more than $16 billion.

Light is the music of glass for makers of fine crystal, such as Waterford of Ireland, Orrefors of Sweden, and Corning's Steuben. It used to be an article of faith that a family have at least one nice piece of crystal in the china closet. It had a good feel to it, heavy - at least a 24 percent lead content - and sensuous. The lead causes light rays to refract, or bend, giving the glass its sparkle②.

The demand for high-quality, handblown crystal dropped in recent years, due in part to popular taste, but more to economic hard times. In addition, some people have questioned the possible health dangers from lead in glass and decanters.

"Our studies show that one would be more likely to die of alcohol poisoning from the contents than from the lead in the decanter or glass itself," one Waterford official told me. Nevertheless, the company applies a polymer coating to the inside of decanters, reducing the lead on the surface to almost undetectable levels.

The secret of glass lies in its interior structure. Although it is rigid, and thus like a solid, some of its atoms are arranged in a random, disordered fashion characteristic of a liquid③. In the melting process, theatoms in the raw materials are disturbed from their normal position in the molecular structure; before they can find their way back to crystalline arrangements, the glass is cooled.

This looseness gives the material "formability", says Coming's Prindle. "You can cast a huge mirror or draw out glass as a fiber. And you can dissolve almost anything in it, in great quantities. To make a brilliant, sparkling glass, add lead oxide or barium oxide to the basic sand-soda-lime mixture. For a heat-resistant glass, throw in boric oxide. For green sunglasses, add chromium and copper."

Not all the glass that touches our lives is high tech. Consider the lowly light bulb. At the turn of the century most light bulbs were handblown and cost the equivalent of half a day's pay for the average worker. In effect, the invention of the ribbon machine by Corning in the 1920s lit the nation. The price of a bulb plunged, and the pale yellow light of those early filaments flickered in households from coast to coast.

And yet the ribbon machine, which has been called one of the great mechanical achievements of all time, is wondrously simple. A narrow ribbon of molten glass travels over a moving belt of steel in which there are holes. The glass sags through the holes and into waiting molds. Puffs of compressed air then shape the glass, making light bulbs 0.02 inch thick. At a rate of 66,000 bulbs an hour, one machine produces nearly 600 million a year. A total of 1.8 billion light bulbs are produced annually in the United States.

Glass ceramics are made stronger than ordinary glass by heating special glass compositions to form fine uniform crystals④. One called Macor, developed by Corning, is strong enough to be worked on a lathe, to have nuts and bolts fashioned of it, and to serve as window frames in the space shuttle. Dicor, also by Corning, is used to make dental crowns that are stronger, plaque resistant and highly translucent.

Glass fiber-optic systems - using lasers no larger than a grain of sand and glass fibers as thin as a human hair - can transmit 32,000 times as much information as the equivalent amount of copper conductor. American, Japanese and Middle Eastern investors are planning the world's longest undersea fiber-optic cable, stretching from the United Kingdom to Japan via the Indian Ocean.

Five fiber-optic cables already link Europe and the United States. Another three connect the U.S. West Coast with Japan. Someday, their signals may connect to optical computers that, at much higher speeds than electronic ones, will process and store vastly more information with pulses from tiny lasers, rather than from electrons.

What is being called the most stupendous work in glass ever is underway at Schott Glaswerke in Mainz, Germany. European Southern Observatory, a consortium of eight nations, called on Schott to help produce the world's largest and most exacting optical telescope.

Currently, the company is working on the second of four mirrors, to be completed this fall. Each mirror, made of a zero-expansion glass ceramic called Zerodur, will less than seven inches thick, yet weigh 22 tons, measure nearly 27 feet in diameter and cover the floor space of a double garage.

After the mirror cools from its 2200 degrees F. pouring temperature to a more manageable 1500 degrees, it is moved to an annealing oven, where it remains for four months, until it cools to room temperature. Perhaps the most heart-stopping moment in the process occurs when a 70-ton crane moves into position above the mold and drops lines attached to vacuum cups that lift the mirror like a massive spaceship. After the mirror is completed, it travels by ship to Paris, where French technicians polish it; then it goes to Chile, where it is placed on the telescope atop the 8658-foot-high Cerro Paranal in the Atacama Desert.

Scientists continue to experiment with new glass mixtures and find new uses. "Glass is the great building material of the future, the 'dynamic skin'," says British architect Mike Davies. "Think of glass that has been treated to react to electric currents going through it, glass that will change from clear to opaque at the push of a button, giving you instant curtains. Think of how the tall buildings in New York could perform in a symphony of colours as the glass in them is made to change colours instantly."

From the Reader's Digest (shortened) July 1994

Phrases and Expressions

1. ceramics *n.* 1. [用作单]陶瓷学；陶瓷工艺；窑业
   2. [用作复]陶器/陶瓷制品
2. surge *n.* 巨浪；波涛；汹涌