THE AIR OCEAN

空气的海洋

英语科普对照注释读物

外语教学与研究出版社

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内 容 简 介

本书选自《今日自然科学》 (*Physical Science for Today*) 一书。原书著者欧内斯特·施奈德 (Ernest E. Snyder) 执教于美国亚利桑那大学。

本书阐明大气层在保护地球上的动植物生命方面所起的作用，分析大气层的组成、温度变化情况和影响温度变化的因素，探索大气层及其某些成分的起源问题、大气层中污染对动植物的危害性、太阳对地球表面的辐射热和地球自转对大气环流和天气的影响以及某些人工改变天气的方法等。

本书每一节原文后都有语法注释和译文，书末附有词汇表和术语注释，可供大、中学生、知识青年和科技人员阅读，对理工科外语教师也有一定参考价值。

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The Air Ocean

Of all the environmental factors affecting humans, the air we breathe is without question the most essential. We actually are bottom-dwellers in an ocean of air and without this precise mixture of gases, which we inhale a thousand times and more each hour, we cannot last for three minutes.

Not only is the air essential① to the normal physiological functioning of all earthly plants and animals, it also is a shield that protects them from certain cosmic objects and radiations. Without this shielding effect of the atmosphere, it is probable that life as we know it could not exist on this planet.② We may be well on the way toward discovering the nature of the probability in one case, at least. Supersonic aircraft (SST's) undoubtedly will reduce the amount of ozone in the stratosphere. This will allow more ultraviolet radiation to reach the earth's surface (and we bottom-dwellers) and we will soon find out how well we can cope with the effects. We will also learn many other things—if we survive long enough to see them take place.

Grammatical Notes

① Not only is the air essential: 以 Not only 开头的句子采用部分倒装的语序，即把连系动词 is 置于主语的前面。essential 是表语。

② it is probable ... planet: 句中 that 引出的是主语从句(句子的真正主语)，句首的 it 是形式主语。as we know it 是方式状语从句，修饰 could not exist。

Translation

空 气 的 海 洋

在对人有影响的一切环境因素中，我们呼吸的空气无疑是最主要的。实际上，我们是空气海洋底的居住者，我们每小时吸入空气一千多次，如果没有这种由各种成分组成并有一定比例的混合气体，我们连三分钟也活不了。

空气不仅为保证地球上的动植物正常生理活动所必需，而且保护它们不受某些宇宙物体和宇宙射线① 的损害。如果没有大气层② 所起的保护作用，地球上很可能就不存在如我们所知的生命了。我们至少在一件事情上朝着发现这种可能性的方向前进了一步。超音速飞机无疑会减少平流层(同温层)③ 中的臭氧的含量，这就会使更多的紫外线到达地球表面（射在我们这些在空气海洋底的居住者身上)，我们不久就会找到对付这种影响的办法。我们还会知道许多别的情况——假如我们能够活到看见它们出现的话。

1. Composition and Origin of the Atmosphere

The atmosphere is a mixture of substances that have such low freezing and boiling points that they exist as gases through a wide range of temperatures. The only exception to this is the water vapor that is present in all air near the earth's surface.

The lower atmosphere, also known as the homosphere, (Figure 1) extends from the surface to a height of about 50 miles. The homosphere is subdivided into three regions: the troposphere, stratosphere, and mesosphere. The troposphere reaches an altitude of about 8 miles (about 40,000 feet) and it is within this region that all weather occurs.① Temperature in the troposphere decreases 3.5°F for each 1000 feet increase in elevation.

The stratosphere extends from the top of the troposphere to about 35 miles altitude. Temperatures in this region remain almost constant for the first 10 miles and then increase to the top of the stratosphere. This increase in temperature is due to the absorption of short wavelengths of solar energy by ozone.* Note that (Figure 1) the ozonosphere corresponds roughly to the stratosphere.

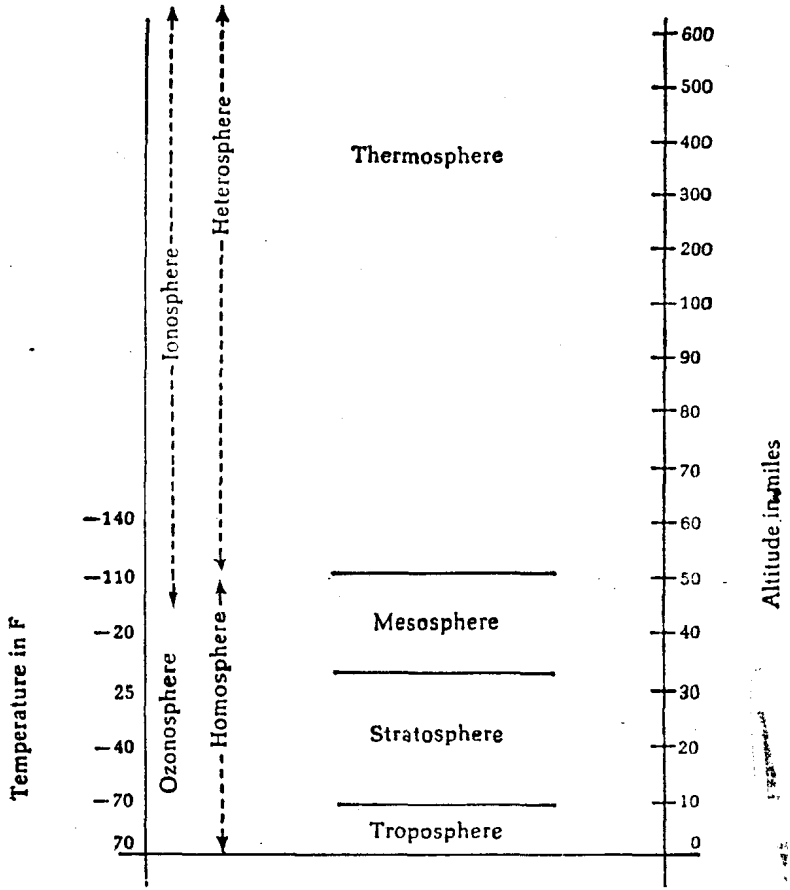

FIGURE 1 Atmospheric distribution.

* Some kinds of energy move through media by effecting a regular, recurring disturbance of the particles or other material of the media. Figure 2 represents the motion of a particle or a point in the medium as it is displaced by the applied energy. Maximum displacement (A) from rest (the horizontal mid-line)

is termed the amplitude of the wave. The quantity (B) from one point on the wave to a successive, corresponding point is the wavelength. The period of the wave is the time (C) required for one complete cycle of the disturbed particle or point. The frequency is the number of cycles per unit of time—cycles per second (hertz) when dealing with electromagnetic wave energy.

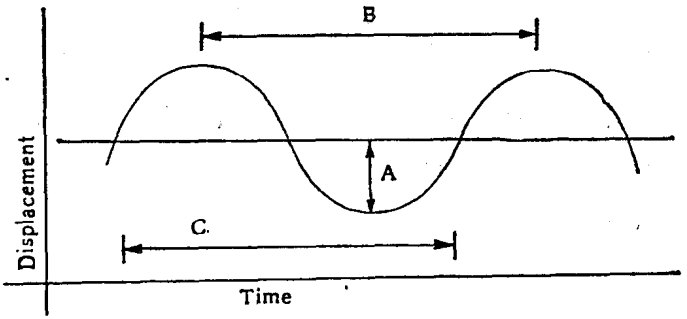

FIGURE 2

The mesosphere lies between the top of the stratosphere and the lower boundary of the upper atmosphere. The temperatures here decrease rapidly from about 30 °F to −140 °F at 55 miles above the surface.

The upper atmosphere (the heterosphere or thermosphere) extends beyond 55 miles to 600 or more miles outward from the earth to the region where the density of atmospheric materials is low enough to be classed as interplanetary space. Note (Figure 1) that the ionosphere includes all of the heterosphere plus the upper 15 miles of the mesosphere. In this area many of the atmospheric atoms are ionized and it is here that radio waves from earthly transmitters are reflect-

ed back to the surface, thus, making possible long range wireless communications.*

* The atoms making up the elements of the universe are normally electrically neutral, that is, each atom contains equal numbers of positively and negatively charged particles which, therefore, neutralize each other. Under certain conditions, however, negatively charged particles (electrons) may be removed from or added to atoms. When this happens, the atom carries a net positive or negative charge and is said to be ionized and the atom is then referred to as an ion.

Nitrogen gas makes up about 78% by volume of the atmosphere (see Table 1). It is a relatively inert substance chemically and exists as a diatomic molecule; that is, two nitrogen atoms are chemically combined to form what the chemist symbolizes as N_2.② The chemical bonds holding the two atoms together are quite strong and this, in part, accounts for the reluctance of atmospheric nitrogen to interact chemically with other materials in the environment. When air is inhaled, the nitrogen component goes in and out of the lungs without undergoing appreciable change or absorption. A certain amount of the gas is dissolved in the blood at all times but apparently does not enter into physiological activities in any way.*

TABLE 1 Lower Atmosphere Composition

Gas	% by Volume
Nitrogen (N_2)	78.084
Oxygen (O_2)	20.946

Argon (A)	0.934
Carbon dioxide (CO_2)	0.033 to 0.1

Remaining 0.003%

Neon (Ne)	Hydrogen (H_2)
Helium (He)	Methane (CH_4)
Krypton (Kr)	Radon (Rn)
Xenon (Xe)	Nitrous oxide (N_2O)

* There can be enough nitrogen in the blood to cause trouble for divers if they ascend too rapidly from deep dives. Additional nitrogen is forced into the blood when the diver breathes air under pressure. When he ascends quickly, the excess nitrogen forms bubbles that block blood vessels at constrictions such as the joints of the extremities. The condition is known as caisson disease or "the bends" and requires divers to undergo long periods of decompression when or after returning to the surface.

Although the element nitrogen is essential to all plants and animals, it cannot be utilized by them in the N_2 form. Atmospheric nitrogen is converted to the required soluble compounds (nitrates of several varieties) by lightning discharges and by bacteria in the soil. Ammonia is another compound useful to plants as a source of nitrogen. This substance is one of the products of the decay of organic matter in and on the surface of the soil.

Oxygen makes up about 21% of the atmosphere and it

also is in the form of a diatomic molecule (O_2). This element is quite active chemically and is absolutely essential to our existence. Its primary activity is to bring about the oxidation of carbohydrate foods we eat to produce the energy necessary to the functioning of our bodies.③ It also is built into most of the myriad of organic compounds of which we are composed.

The other one percent of atmospheric gases consists of carbon dioxide (CO_2), the rare gases, hydrogen, and a few unimportant compounds in minute quantities. Water vapor (which is just as invisible as the other gases) may vary from almost nothing to as much as 4% and is not usually included with the other constituents which, in terms of global averages, do not vary significantly. The amounts listed here for the composition of the atmosphere are only for the denser portion lying near the surface of the earth. Above an altitude of about 50 miles, the relative percentages change noticeably with the heavier molecules occupying the lower elevations.④ Also, between about 8 and 40 miles up, we find ozone as an additional and important constituent.*

* Ozone (O_3) forms in the atmosphere as a result of the energy supplied by electrical discharges and the ultraviolet radiation that reaches the upper atmosphere from the sun.

There is little direct evidence to help us draw conclusions about the origin of the earth's atmosphere. We may

only speculate to some degree on the basis of the compositions of atmospheres around other planets in the solar system. The larger, more distant planets (Jupiter, Saturn, Uranus, and Neptune) all have atmospheres that are mostly methane (CH_4) and ammonia (NH_3). It is thought that the earth and the other smaller planets at one time had similar atmospheres. The relative close proximity of these planets to the sun, however, plus the probable high surface temperatures provided means for photolysis* and pyrolysis** of these molecules. This decomposition of methane and ammonia has not occurred on the outer planets because of their extremely low temperatures and great distances from the sun. Another possibility is that the CH_4 and NH_3 molecules of the original atmospheres of the smaller planets could have escaped the relatively weak gravitational fields when the particles were accelerated to their escape velocities by the high temperatures of the surfaces.

* Photolysis is the breaking of molecular chemical bonds by the energy of electromagnetic radiation. Photochemistry has to do with those chemical reactions affected by light.

** Pyrolysis is the decomposition of chemical compounds by the application of heat energy.

In any event, the present atmosphere of oxygen, nitrogen, carbon dioxide, and water vapor of the planet Earth differs from all the others and this uniqueness is difficult to explain satisfactorily. It is believed that N_2, CO_2, and H_2O

were vented from the earth where they had been a part of the molten rock of the crust. This exhalation of subterranean gases continues today through volcanic eruptions in many parts of the world.

There are two leading hypotheses regarding the origin of oxygen in the earth's atmosphere. The first is that as green plants evolved and carried on photosynthesis, the oxygen component gradually increased as the plants emitted excess oxygen and consumed carbon dioxide.[5] As animal life increased over the surface of the globe, an eventual balance was reached with plants using CO_2 and excreting O_2 at about the same rate that animals were doing just the opposite.[6] The second hypothesis is that oxygen was released from water vapor (H_2O) molecules as a result of photolytic decomposition. The overall representative chemical reaction is:

$$2H_2O + \text{radiant energy} \rightarrow O_2 + 2H_2$$

The hydrogen, because of its slight mass, was able to escape from the earth's gravitational field while the heavier O_2 molecules were left behind,

The planet Mercury appears to have no atmosphere. This probably is due to its weak gravitational field and closeness to the sun. Mars has a relatively thin atmosphere which also is due to its small mass. Venus, on the other hand, being comparable in size and mass to Earth, has a dense atmosphere consisting of a large percentage of carbon

dioxide with a relatively small amount of oxygen. The greenhouse effect occasioned by the heavy CO_2 concentration causes the temperature at the surface to be near 1000° F.*

* When incident solar radiation passes through a transparent substance such as glass or the atmosphere and is then absorbed by solid matter, much of the energy is converted to long wave heat radiation. This longer wavelength energy cannot move back through the transparent material and is, therefore, trapped beneath it. You may have observed the effect upon opening your automobile after it has been sitting for some time in direct sunlight with the doors and windows tightly closed. Carbon dioxide in the atmosphere acts in a manner comparable to the glass windows in a car or greenhouse.

An interesting (albeit not widely accepted) hypothesis explaining the great contrast between the atmospheres of Earth and Venus assumes that intelligent beings (humanoid ?) evolved on Venus several centuries or millennia ahead of the similar development on Earth. The Venusian "civilization" learned to use fossil fuels, destroyed the oxygen-producing forests, polluted the carbon dioxide-absorbing seas, and perished when the CO_2–O_2 atmospheric balance went away. Fantasy? Possibly. But it could have happened; perhaps we should think about it.

Grammatical Notes

① it is within this region that all weather occurs: 这是一

个强调句型：It is (was) ＋被强调的句子成分＋ that ＋原句中的其余部分。它相当于 all weather occurs within this region。所以，上述句中被强调的句子成分为状语：within this region。根据需要，这种句型还可强调主语和宾语。例如，就上句来说，还可强调主语：it is all weather that occurs within this region。

② two nitrogen atoms ... as N_2: 不定式短语 to form what the chemist symbolizes as N_2 作结果状语，修饰谓语 are combined，其中 what 又引出宾语从句，作 to form 的宾语。在这个宾语从句中，what 是谓语 symbolizes 的宾语，as N_2 是宾语补足语。

③ Its primary activity ... of our bodies: 句中 we eat to produce the energy 为定语从句，修饰 carbohydrate foods，省略了作 eat 宾语的关系代词 that (或 which)。necessary to the functioning of our bodies 为形容词短语，作后置定语，修饰 energy。

④ the relative percentages change noticeably with the heavier molecules occupying the lower elevations: "with＋名词＋分词(短语)"结构通常作状语，修饰动词，在这里，修饰谓语动词 change，表示伴随情况。

⑤ The first is that ... dioxide: 全句是一个带有表语从句的复合句，句中 as green plants evolved and carried on photosynthesis 是原因状语从句，as the plants emitted excess oxygen and consumed carbon dioxide 是时间状语从句，同时修饰谓语动词 increased。

⑥ at about the same rate that animals were doing just the opposite: that 在这里相当于关系副词 as，引出定语