郑锡荣 郑捷 王鲁萍 编译

英 ENGLISH-CHINESE SCIENCE FLORILEGIA

汉 英汉科学百花园

AIR WATER AND SOIL

空气 水和土壤

山东教育出版社

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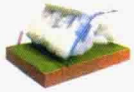

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SHANDONG EDUCATION PUBLISHING HOUSE

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CONTENTS
目录



1 Atmosphere: the layer of gases that surrounds the Earth
大气：包围住地球的气体层

9 Air
空气

25 Water
水

43 The oceans
海洋

49 Soil
土壤

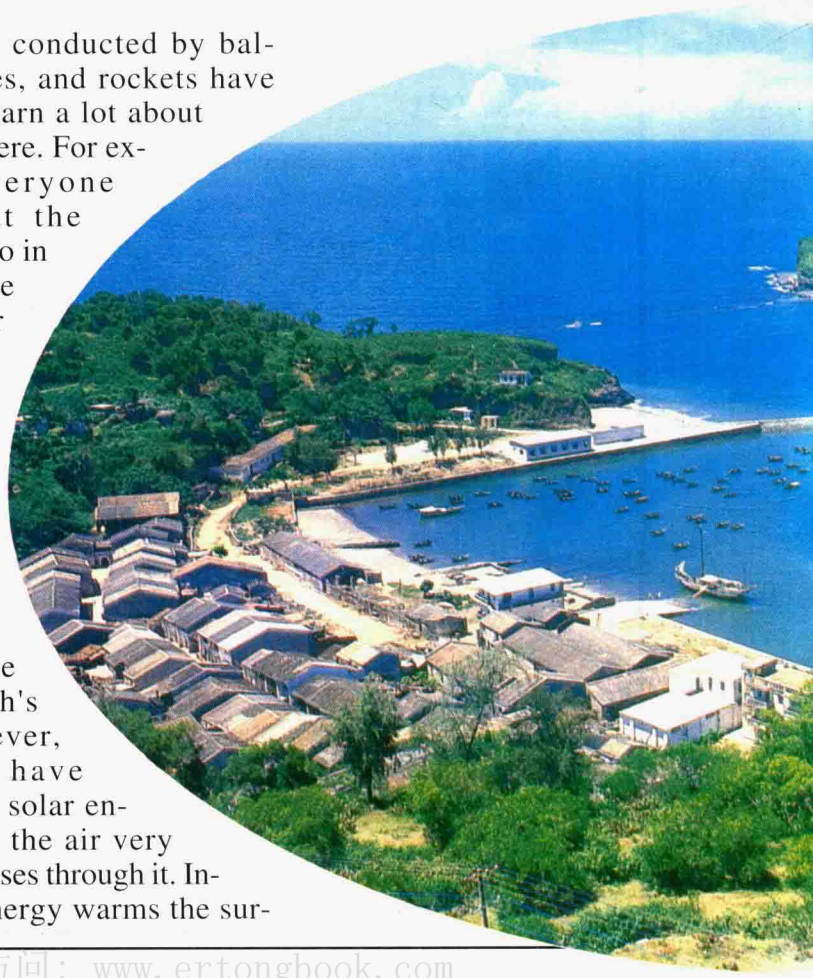
ATMOSPHERE:THE LAYER OF GASES THAT SURROUNDS THE EARTH

大气：包围住地球的气体层

If the scientists had taken their air samples in a place free from pollution, their tests would have had the following results. About 79% of each sample would have been the gas nitrogen. Nitrogen is the most abundant gas in the earth's atmosphere. The second most common gas is oxygen that would have made up about 20% of the sample. The remaining 1% would have contained mostly argon, carbon dioxide, and water vapor.

Studies conducted by balloons, planes, and rockets have helped us learn a lot about our atmosphere. For example, everyone knows that the higher you go in a balloon, the lower the air temperature is. At first, this may seem strange since you are getting closer to the Sun that is the source of the Earth's heat. However, scientists have learned that solar energy warms the air very little as it passes through it. Instead, the energy warms the surface of the Earth, which in turn warms the air near it.

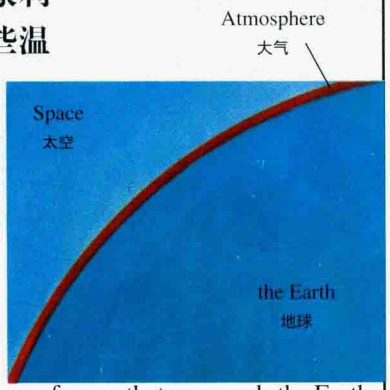
For years, scientists felt that as you went higher, the temperature would continue to drop steadily until it reached the deep cold of space. Surprisingly, this was found not to be the case. There are several levels at which the temperature changes reverse direction. Scientists use these temperature changes to divide the atmosphere into layers.



如果科学家在无污染处给空气取样，他们的试验将取得以下结果。每次抽样的约 79% 会是氮气。氮气是地球大气中含量最多的气体。第二多的气体是氧气，约占取样的 20%。剩下的 1% 主要是氩气、二氧化碳和水蒸气。

通过用气球、飞机和火箭进行研究，我们知道了许多有关大气的情况。例如，每个人都知道，你乘坐气球升得越高，空气温度就越低。乍看起来，这似乎很奇怪，因为你离作为地球热量来源的太阳越来越近。不过，科学家已经知道，太阳能量通过空气时对它的加温作用非常之小。阳光主要是把地球表面晒热，从而使地面附近的空气升温。

多年来，科学家认为，随着高度增加，温度将持续下降，直到进入异常寒冷的太空。令人惊奇的是，情况并非如此。在几个高度上，温度变化发生逆转。科学家利用这些温度变化把大气划分成若干层。



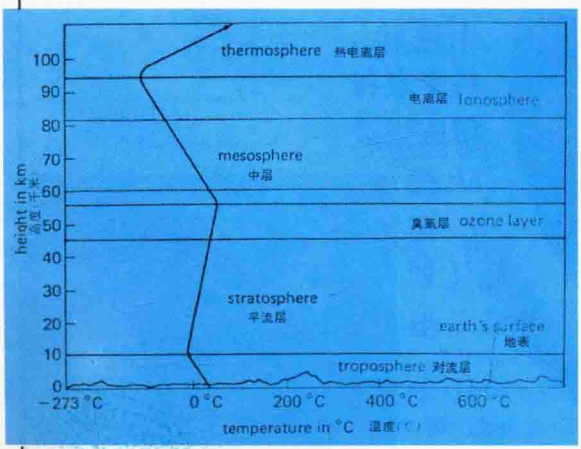
Atmosphere:the layer of gases that surrounds the Earth

大气：包围住地球的气体层

The layer closest to the Earth is called the troposphere. This is the layer in which we live. Because of the pull of the earth's gravity, about 90% of the gases that make up the atmosphere are found in this layer. It is in the troposphere that most of the changes we call weather occur. Temperatures in the troposphere average about 15℃ near the surface and decrease to about -55℃ as you move upward.

At a height of about 11 km, the temperature starts to increase. This marks the beginning of the second layer, called the stratosphere. The boundary is not sharp. The temperature gradually starts to increase with altitude to a high of about 10℃. Air in the stratosphere is thinner than in the troposphere. It contains very little moisture and dust. As a result, there is practically no weather there.

Around 50 km above earth's surface, the stratosphere contains a high percentage of a gas called ozone. Ozone is a form of oxygen that absorbs most of the harmful ultraviolet rays from the Sun. Absorbing this energy is what causes the higher temperatures in this layer. Many scientists are concerned that pollution in the atmosphere may be breaking down the protective layer of ozone. If this happens, strong ultraviolet rays could be harmful to life on the Earth. It could also change the earth's climate.



The layers of the atmosphere are determined by temperature changes.

按温度变化确定大气的各个层次。

The stratosphere also contains a broad, fast flowing "river" of air circulating around the world. This is called the jet stream. The jet stream plays an important role in controlling the weather in the troposphere below. Jet planes often fly in the stratosphere to avoid bad weather or to be "carried" by the jet stream.

Above the ozone layer of the stratosphere, temperatures begin to drop once more. This is the beginning of the mesosphere. At the top of the mesosphere, about 80 km above the earth, temperatures reach -75℃. These temperatures start to rise again in the top layer of the atmosphere, the thermosphere. There is no exact end to the thermosphere. The gases just continue to spread out until you are in space. This is thought to occur somewhere around 600 km high. Even though the gases are so thinly spread here, the temperature of the thermosphere may reach 2,000℃. This is due to the solar radiation there gases absorb.

最靠近地球的那一层叫做对流层。我们就生活在这一层里。由于地球的引力作用，组成大气的气体约有90%都在这一层里。正是在对流层里，发生着我们称之为天气的大部分变化。对流层的温度在近地表处平均约为15℃，而后随着高度增大而下降至约-55℃。

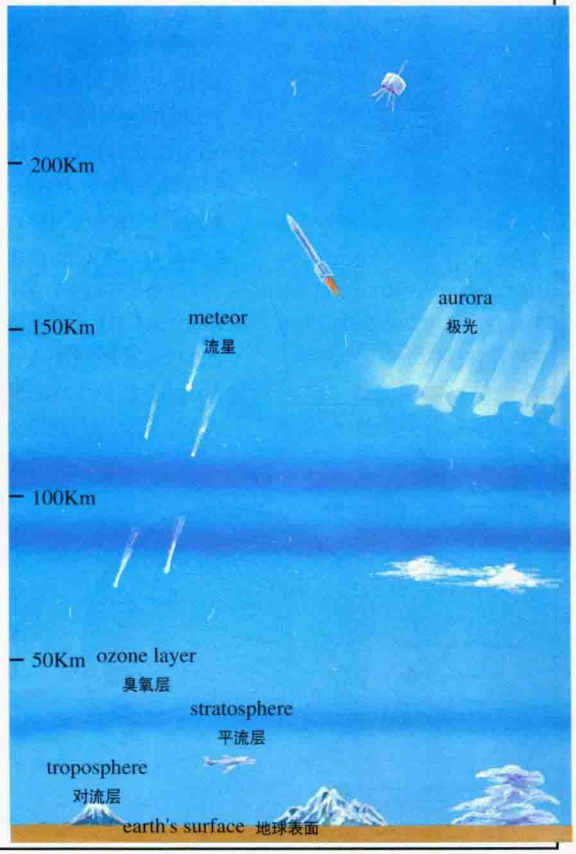
在约11千米高处，温度开始上升。这标志着叫做平流层的第二层的开始。界限并不明显。温度随着高度增大而逐渐上升到约10℃。平流层空气比对流层的稀薄。它的水蒸气和尘埃含量极少。因此那儿实际上无所谓天气。

在距地表约50千米上空，平流层含有高百分比的臭氧气体。臭氧是氧气的一种形态，能吸收阳光里有害紫外线的一大部分。正是因为吸收这部分能量，使得这一层的温度变得较高。许多科学家担心，大气受污染可能破坏臭氧保护层。要真是这样，强烈的紫外线可能危及地球上的生命。它还可能改变地球的气候。

平流层里还有一道环绕全球的宽阔、快速流动的空气“河流”。这就是所谓的急流。急流在控制其下的对流层天气方面起重要作用。喷气机常常在平流层里飞行，以避开恶劣天气，或是让急流“推着飞”。

到了平流层的臭氧层以上时，温度再次开始下降。中层就此开始。在地表以上约80千米处的中层顶部，温度降至-75℃。到了大气最高层的热电离层，这一温度又开始回升。热电离层没有确切的尽头。气体一直继续扩展，直到进入太空为止。一般认为这种情况发生于约600千米高处。虽然这里的气体异常稀薄，但热电离层的温度可高达2,000℃。其起因是由于那儿的气体吸收了太阳辐射。

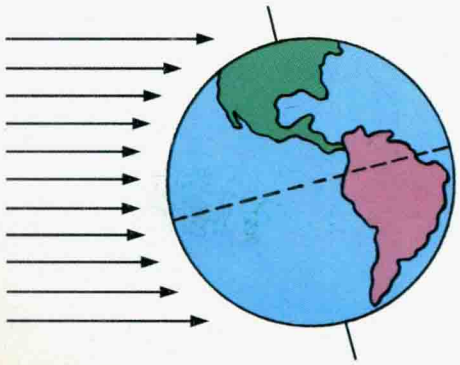
Scientists use these temperature changes to divide the atmosphere into layers.
科学家利用这些温度变化把大气划分成若干层。



When solar energy is absorbed by air molecules, the atoms either gain or lose electrons. Many of the gas molecules between 80 and 400 km have become electrically charged particles called ions. This part of the mesosphere and the thermosphere is called the ionosphere. The ionosphere is important in communications. It can reflect many types of radio waves, allowing them to be "bounced" around the world.

About 20% of the solar radiation that reaches the earth is absorbed by the gases in the atmosphere. Another 33% is reflected back into space by clouds, snow, and ice. Most of the 47% that reaches the surface of the earth is visible light. This radiation is absorbed by the land and oceans. However, it is not evenly distributed over the earth's surface.

Several factors affect the spread of this radiation over the earth . The first is the earth's shape. Since the Earth is a sphere, the sun's rays strike different places at different angles. Near the equator the Sun passes almost directly overhead. Here these direct rays warm the surface the most. North and south of the equator, the surface of the sphere curves away from the Sun. Thus the rays strike at a lower angle and spread out over greater distances. As a result, these locations receive less solar energy than the equator. The poles receive the least energy.



The equator receives direct rays of sunlight, but the poles receive slanting rays.

赤道接受直射阳光，而两极则接受斜射阳光。

A second factor is that land and water do not absorb energy at the same rate. Land warms up faster than water does. At night or in the winter, the land loses its heat and cools down faster than the water. Other factors include the tilt of the earth's axis, its day and night periods, and its path around the Sun.

This unequal spreading of radiation causes unequal heating of the earth's surface. Since the atmosphere is heated by the surface beneath, it too is heated unequally. Air near the equator is heated more than air near the poles. Heated air expands. This means that warm air at the equator is less dense than cold air at the poles. The density of the air determines the force with which it presses down on the earth's surface. This force is measured as air pressure. Cold air presses down on the earth with a greater pressure than does warm air. Cold air is said to have a high pressure. Warm air is said to have a low pressure.

These density differences are also the reason why air moves. In general, air flows from a region of high pressure toward one of low pressure. Thus, cold, dense air from the poles would flow toward the equator along the surface of the

当空气分子吸收太阳能量时，其原子不是获得电子就是失去电子。在80～400千米高处，许多气体分子成为带电粒子，称为离子。中层和热电离层的这一部分称为电离层。电离层对通讯很重要。它能反射多种无线电波，使它们能围绕地球“反弹”。

到达地球的太阳辐射中约有20%被大气里的气体吸收掉。另有33%被云层、雪和冰反射回太空。到达地球表面的47%大部分是可见光。这部分辐射被陆地和海洋所吸收。不过，这部分辐射在地球表面也并非均匀分布的。

影响这部分辐射在地表分布的因素有几个。首先是地球的形状。由于地球是球体，因此阳光射向各处的角度不同。在靠近赤道处，太阳几乎在头顶上空垂直照射。在这儿，这些直射阳光对地表加热最甚。在赤道以北和以南，地球表面朝远离太阳的方向弯曲。于是，阳光以较低角度入射，散开的距离也更大。结果，这些地区接受的太阳能比赤道少。两极接受的热量最少。

因素之二是陆地和水面的能量吸收率并不一致。陆地升温要比水快。在夜晚或冬天，陆地也比水面更快失去热量和冷却。其他因素还有地轴的倾斜，昼和夜的周期，以及地球的绕日轨道。

辐射的这种不均等分布引起了地球表面的不均等受热。由于大气是由其下方的地表来加热的，因此大气的受热也不均等。赤道附近的空气要比两极的受热更强烈。热空气会膨胀，这使得赤道的暖空气不如两极冷空气的密度大。空气的密度决定它对地表压力的大小。这种力以空气压强来计算。冷空气对地面的压力大于热空气。于是我们说冷空气具有高压。暖空气则具有低压。

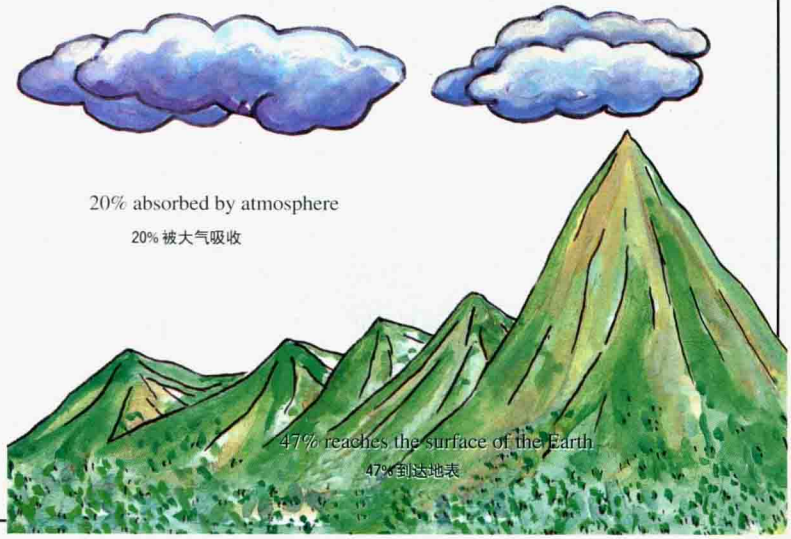
密度差异也是空气流动的起因。一般来说，空气会从高压地区流向低压地区。于是，两极冷而密

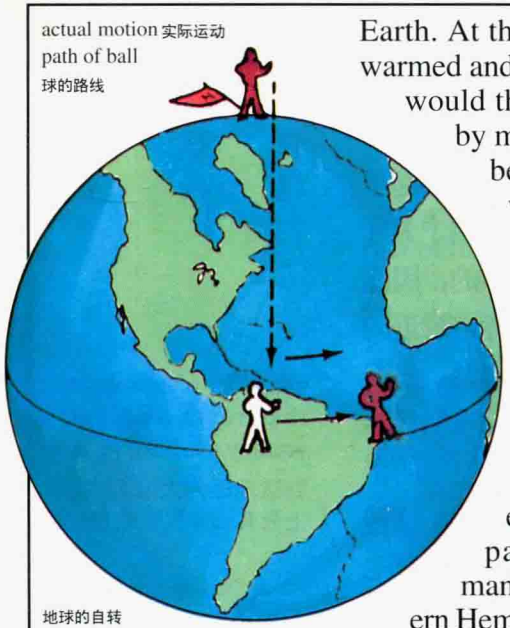
Only 47% of the solar rays that reach the Earth actually reach the surface.

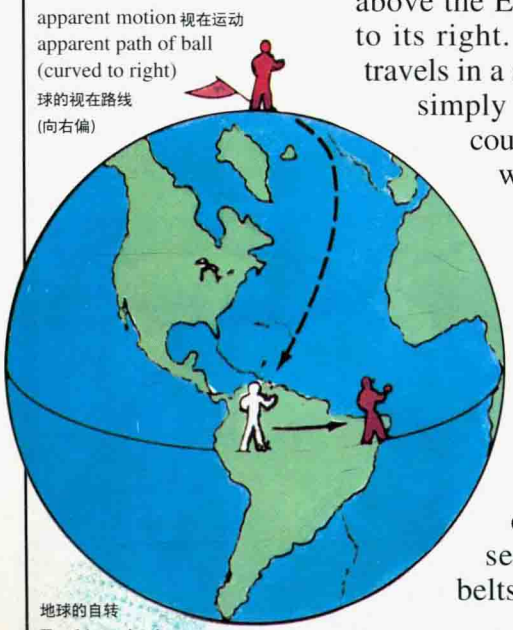
到达地球的太阳辐射实际上只有47%到达地表。

33% of the sunlight reaching the Earth is reflected.

到达地球的阳光33%被反射掉。







The Coriolis effect is a result of the Earth's rotation.
科里奥利效应是地球自转的结果。

Earth. At the equator, it would be warmed and expand. The warm air would then be pushed upward by more cold air moving in behind it. The warm air would flow back toward the poles at the top of the troposphere. Here it would cool, become denser, sink, and flow back toward the equator. The upper right illustration shows this general circulation. This pattern is affected by many factors. In the Northern Hemisphere, the path of any object traveling north or south above the Earth appears to curve to its right. Actually, the object travels in a straight line, the Earth simply moves beneath it. Of course, this is more visible when the object is traveling long distances. This is called the Coriolis effect. In the Southern Hemisphere, the effect is an apparent curve to the left.

The Coriolis effect breaks the general circulation into a series of smaller wind belts. In each hemisphere, rising air near the equator produces a calm region called the doldrums. Here there are only weak surface winds.

In the upper parts of the troposphere, the warm air rising from the doldrums turns north and south. As this air moves toward the poles, it is cooled. About one fourth of the way to the poles, most of this air sinks back to the surface. In this area of sinking air, there is also little surface wind. At the surface, the sinking air divides. Some of it flows toward the equator. The Coriolis effect turns this air so that it blows from the east. This creates the warm and steady belt of trade winds.

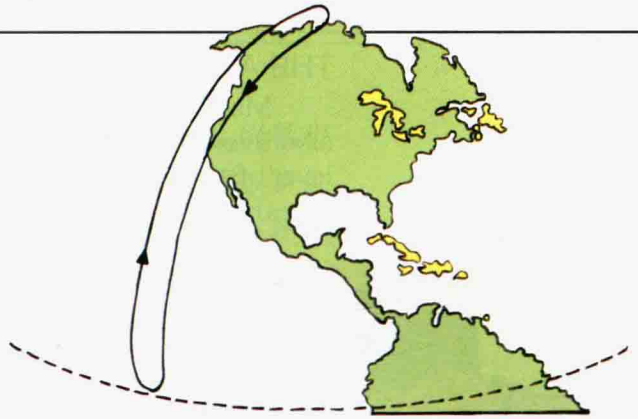
The rest of the sinking air moves along the surface toward the poles. The Coriolis effect and other forces turn this wind so it blows from the west. These wind belts are called the westerlies. It is very hard to explain why this belt exists. We will just say that it does. Most of China is beneath this belt so most of our weather moves from west to east.

The westerlies blow northeastward until they meet with very cold air moving along the surface toward the equator. This is the cold sinking air from the poles. It too has been turned by the Coriolis effect until it seems to come from the east. This belt of winds is called the polar easterlies.The movements of the major wind belts are a major factor in controlling the weather.

度大的空气会沿地球表面流向赤道。在赤道上，它将受热而膨胀。暖空气会被随后流动过来的更多的冷空气向上托起。暖空气将在对流层顶部流向两极。在那儿，它又被冷却，密度变大，下沉并流回赤道。右上图表明这种一般流动情况。这种环流模式受许多因素影响。在北半球，在地表朝北或朝南运动的任何物体似乎会向右偏转。实际上，物体是沿直线运动的，只不过地球在其下方运动罢了。当然，要是运动距离远，这种情况就更加明显。这叫做科里奥利效应。在南半球，这种效应表现为视在偏左。

科里奥利效应把大气环流分裂成一系列较小的风带。在每个半球，近赤道的上升空气产生出叫做赤道无风带的静风区。在这儿只有微弱的地表风。

在较高的对流层部分，从赤道无风带上升的暖空气转向北方和南方。这些空气流向两极时被冷却。在到两极距离约1/4时，这些空气的大部分沉回地表。在这个沉降空气地区，也极少有地表风。在地表，沉降空气分散开来。其中一部分流向赤道。科里奥利效应作用在这部分空气上，使它从东面吹来。这就形成了温暖稳定的信风带。

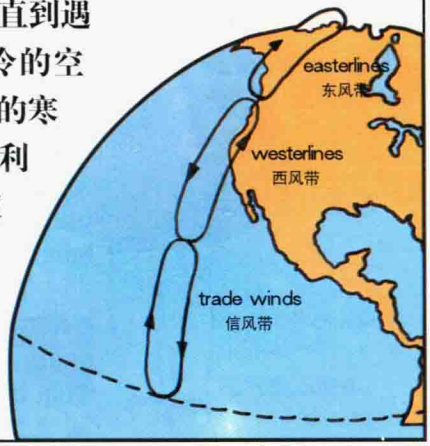


Cold, dense polar air flows toward the equator, while warm, less dense air rises and flows toward the poles.
冷稠的极空气流向赤道，暖而密度较低的空气上升并流向两极。

余下的沉降空气沿地表流向两极。科里奥利效应以及其他力量使其发生偏转成为西风。因此这些风带称为西风带。很难解释这个带为什么会存在。我们只能说它确实存在着。中国大部分地区处于这个风带之下，所以我们大部分的天气变化自西向东移动。

西风带吹向东北方，直到遇上沿地表流向赤道的极冷的空气。这是来自两极的沉降的寒冷空气。它也因受科里奥利效应作用而发生偏转，使它似乎是从东吹来。这一风带称为极地东风带。主要风带的运动是影响天气的主要因素。

The earth's wind belts are effected by the Coriolis effect.
地球的风带受科里奥利效应的影响。



空气 AIR

THE ATMOSPHERE

Man lives on the Earth. But he also lives in a blanket of air. This layer of air that surrounds the Earth is called the atmosphere. The atmosphere surrounds the Earth completely and is about 1,500 kilometers thick. The atmosphere influences the land and sea areas that lie below it, and these areas, in turn, influences the atmosphere that lies above.

Without the atmosphere, we would not be able to live on the Earth. There would be no air for us to breathe. The Earth would be very, very hot in the day and very, very cold at night.

Air is all around us.
我们周围到处是空气。

Things to Do

(i)Stretch out your hand in line with your shoulders. Swing it quickly round. What can you feel?

What you felt is the air. We cannot see the air but we can feel it. We feel it when it is moving. We can also feel it when we move in it.

(ii)Now take a piece of paper in your hand. Swing your hand round again. You can see that the piece of paper is bent when your hand is moving.

The air pushes against things when they move in it. It pushed against the paper when it moved. That is why the paper became bent

The atmosphere
大气

大气

人类生活在地球上。但他也生活在一层空气之中。这层裹住地球的空气称为大气。大气把地球完全围住，其厚度约为1,500千米。大气层影响其下的陆地和海洋地区；反过来，这些地区也影响其上的大气层。

没有大气，我们就不能在地球上生活。就会没有空气供我们呼吸。地球在白天会非常、非常之热，而在夜里则会非常、非常之冷。

动手做

一、伸手抬至肩高。快速挥动你的手。你能感觉到什么吗？

你感觉到的就是空气。我们看不见空气，但能感觉到它。当它运动时我们能感觉到它。我们在它里面运动时，也能感觉到它。

二、现在手拿一张纸。再挥动你的手。你会看到你的手运动时纸片会弯曲。

空气会推压在它里面运动的物体。当纸片运动时，空气就推压它。这就是当你挥动纸片时

Air pushes against things.
空气推压物体。

when you moved it. You can feel the air pushing against you when you are in a moving car. You can also feel it when you cycle or run.

When air moves, it is called a wind or breeze. Sometimes the air moves very fast and causes a very strong wind. A strong wind can destroy things. It can blow down trees and houses.

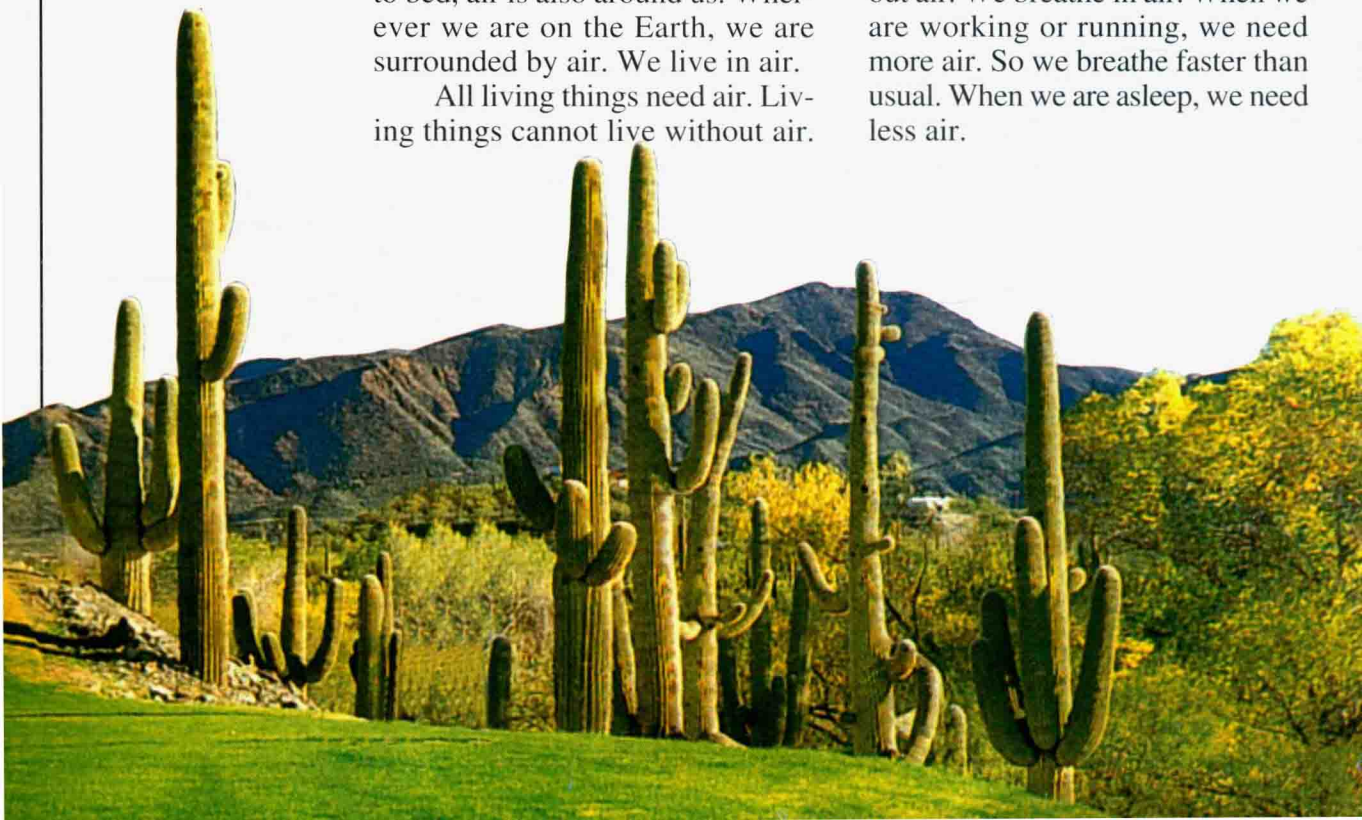
DO LIVING THINGS NEED AIR?

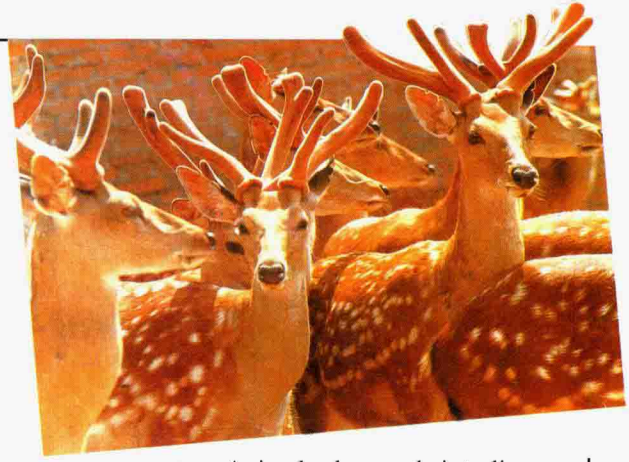
Air is all around us. It is around us as we walk and play. From the moment we are born, we are surrounded by air. When we sit down, it is around us. When we go to bed, air is also around us. Wherever we are on the Earth, we are surrounded by air. We live in air.

All living things need air. Living things cannot live without air.

We can go without food or water for a few days, but we cannot live for more than a few minutes without air. We breathe in air. When we are working or running, we need more air. So we breathe faster than usual. When we are asleep, we need less air.

Plants need air to live.
植物活着需要空气。





Animals also need air to live.
动物也需要空气才能生存。

它会弯曲的缘故。坐在行驶的汽车中，你能感觉到空气在推压你。你骑自行车或跑步时也会感觉到它。

空气流动时，就叫做风或微风。有时空气流动得非常之快，形成了强风，强风会毁坏东西。它会拔树倒屋。

生物需要空气吗?

我们周围到处是空气。在行走和玩耍时我们身处其中。从我们呱呱坠地开始，便被空气所包围。坐下时，它在我们周围。睡觉时，空气仍在我们周围。不管在地球何处，我们都在空气包围之中。我们生活在空气里。

所有的生物都需要空气。生物要生存不能没有空气。我们几天不吃不喝还能行，但只要一刻没有空气就活不下去。我们在空气中呼吸。我们工作或跑步时，就需要更多的空气。因此我们的呼吸会比平常加快。我们睡觉时，需要的空气就较少。

AIR OCCUPIES SPACE

When you pack your bag with books, your books occupy some space in your bag. If you ask your friends to put their books in your bag, there will come a time when no more books will enter your bag. This is because all the books occupy space and the space in your bag is not big enough for all the books to enter.

All things must occupy space. Air too occupies space. We cannot see air, so how do we know that it occupies space?

Things to Do

Let's find out if air occupies space. Crumple a piece of paper, and put it in a jar such that when you overturn the jar, the paper will not fall out.

Fill a bucket with water and slowly push the jar upside down into the bucket of water. Make sure the jar is upright all the time it is being pushed down. Do not tilt it. Do you see water entering the jar?

Now remove the jar from the bucket of water and examine the piece of paper. Is it wet? The paper remains dry because water did not enter the whole jar. Air was in the jar and it prevented the water from entering the whole jar. This shows that air occupies space.

AIR CAN TAKE THE PLACE OF LIQUIDS

If you fill a bottle with water and turn it upside down quickly you will see that, as the water comes out of the mouth of the bottle, large bubbles of air rush in to take the place of the water. Does this happen with other liquids?

Things to Do

Take a coconut. Make a hole in it. Try to pour the "water" out of the coconut. Can you do it? Now make another hole not too close to the first. Pour the "water" out of the coconut. Are two holes better than one for pouring "water" out of a coconut? Yes. As the "water" comes out of one hole of the coconut, air rushes in through the other hole to take the place of the "water".

one hole
一个洞

two holes
两个洞

Can air take the place of coconut "water"?
空气能取代椰子"水"的位置吗?

Why is it easier to pour the "water" out of a coconut with two holes?
为什么有两个洞时更容易把椰子里的"水"倒出来?