英语科普注释读物

A BOOK OF SCIENCE

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[英] 科林·罗南 著

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注释者的话

本书系英国牛津大学出版社《牛津少年参考丛书》的一个分册(一九七〇年版)，由科林·罗南 (Colin Ronan) 撰写，彼得·诺思 (Peter North) 插图。

本书是一本科学知识读物，语言流畅，图文并茂，通俗易懂，可供广大英语学习者阅读。

全书共四十三章，分上下两册出版，对书中较难的语言现象作了必要的注释，各书末附有词汇表。

由于水平有限，注释中难免有错，希望读者批评指正。

一九八〇年元月

原　序

在我们周围每天都发生着一些不同寻常的事情，对这些事情我们往往视为当然。当我们开始想一想时，便会问个为什么。为什么茶在真空瓶里能保暖？为什么我们在听到雷声以前先看到闪电？为什么当你照镜子时，看到的是相反的方位，应该是左臂的地方却是右臂？是什么使电流通过电线并让灯泡发光？如果你用力地摩擦什么，例如擦桌子或用橡皮摩擦时，为什么会发热？

当我们对诸如此类问题寻找答案时，我们就感到必需对形成自然界的万物的情况及其构成要有较多的了解。铁和木有什么区别？我们为了维持生命而呼吸的空气是什么？宇航员在没有空气的太空飞行时为什么必须随身携带空气？为什么燃烧时会发热？热是一种什么现象？电是从哪里来的？我们说光和声、无线电和紫外线是波，是什么意思？

如果你阅读本书，就能找到这些问题的答案。答案并非总是十分简单，有些事就连科学家自己也不能完全解释清楚。有时，他们能告诉我们发生了什么，但还不知道是怎样发生的。科学家从不把任何事情看作是当然的事情；他总是努力通过实验来证明他的设想是否符合实际。所以，你会看到本书往往建议你可以通过实验来向你自己证明本书所告诉你的确是真实的。科学家常做的另一件事，是十分仔细地观察正在他周围世界里发生着的事情。许多关于科学家的故事，谈到他们注意和思考旁人司空见惯、视为当然的事情，从而发现了重要的事实。第一次真正注意到一条船在地平线上逐渐

消失时其船桅尖最后消失的那个人，认识到地球是圆的，而不象以前人们所相信的地球是平的。艾萨克·牛顿和伽利略等伟大科学家就是这样作出了重要的发现的。

科学家们懂得的东西总是越来越多。一百年以前，本书所作的许多解释是无法得出的；再过一百年，许多现在使我们迷惑不解的东西将会为人所了解。那就是为什么做一个科学家是那样令人神往。

CONTENTS

1. SOLID THINGS *

If you *go camping*[1], you will need to *set up a tent*[2], and this means that tent pegs must be hammered into the ground. Using a wooden mallet, you *hammer in each peg*[3] until there is enough of it in the ground to *keep a firm hold on*[4] the guy-rope from the tent. Yet *however much the tent peg has to be hammered into the ground*[5], it always keeps the same shape. This is because the peg *is made of*[6] solid wood, and is harder than the ground.

The wood for a tent peg comes from a tree, but before the tree can be used for making pegs or planks, or anything else, it must be felled. An axe is often used for *felling a tree*[7]. The head of an axe is made of a solid metal such as iron or steel, *which is much harder than wood*[8]. When the woodman *swings his axe against a tree*[9], the axe keeps its shape, but the softer tree does not, and pieces are chipped off. When enough of the tree trunk is chipped

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* 固体 1. 去野营. 这是由 "go +现在分词" 组成的结构. 类似的还有 go fishing (去钓鱼), go hunting (去打猎), go skating (去滑冰)等. 2. 搭起帐篷. 3. 把每个桩 (锤)打进去. 等于 hammer each peg in, in 是副词. 4. 紧紧拉住. 5. 不论帐篷桩得打入地里多深. 这是让步状语从句. 6. 用……制造的. 7. 砍倒一棵树. fell 是规则变化的及物动词. 8. 它比木头硬得多. 这是非限制性定语从句, which 指 a solid metal. 副词 much 修饰形容词比较级形式 harder. 能用于修饰形容词(或副词)比较级形式的副词常见的还有 far, very much, still, even 等. 9. 挥动斧头砍树.

away, the tree falls and can be sent to the sawmills where it is sliced up with steel saws. *It can even be ground up into sawdust, when it has none of its shape left at all.*[10]

Although most metals are far harder than most kinds of wood, *they are not the hardest substances known*[11]. The hardest thing of all is a diamond, and its pointed edge will easily scratch a tough metal such as steel. Indeed, it is possible to make a saw that has diamond *instead of*[12] metal teeth, and it will *not only* cut metal *but*[13] will even slice straight through a block of glass.

If, then, we want to cut something that is solid, we must always do so with another solid that is harder. *For instance, it is no good trying to hammer a wooden peg into a brick wall*[14] because the brick is too hard and the wood will break. Yet a steel nail will certainly go in, *since*[15] steel is far harder than brick.

Solid things, therefore, keep their shape *except when they are hit by other solids which are harder*[16]. But *solids vary in other ways as well as hardness*[17]. If we throw stones

10. 它(指树)甚至可以被碾成木屑，那时就一点儿也没有树的形状了。grind (up) ... into... 把……碾(碎)成……。left 是过去分词，作定语，修饰 its shape。 11. 它们并非是人们知道的最硬的物质。known 是过去分词，作定语，修饰... substances。 12. 代替，而不是。diamond 后面省略了 teeth。 13. 不但……而且……。 14. 比如，试把木桩锤进砖墙是徒劳的。这里，trying ...动名词短语是句子的主语，it 是形式主语。又例如：It is pleasant meeting you here. (在这儿见到你很高兴)。 15. 因为。 16. 除了当它们受到其他更硬的固体打击的时候。when they are ... harder 作介词 except 的宾语。注意：在英语中只有极少数介词(如 except, until, apart from 等)后面能跟副词性从句作宾语。 17. 不同的固体不但硬度不同，其他方面也不同。这里的 as well as 相当于 not only ... but also ...，作"不但……而且……"解。

at them, *for example*[18], the result is different for different substances. A stone *thrown at the steel pillar of a bridge*[19] will bounce off and, *except perhaps for making a small dent*[20], it will *have no effect at all on the steel*[21]. A stone thrown at a brick wall will also bounce off, but this time, instead of making a slight dent, it will chip a small piece out of the wall. Brick is not as tough as steel, and also *it does not bend or 'give' a little as steel does*[22], but it is far more 'brittle', consequently the brick chips. Glass, too, is hard, as brick and steel is, but it is very much more brittle than either. A stone thrown at a glass window will crack or even shatter the glass altogether.

There are some solids that 'give' or bend quite easily and are not brittle at all. The stone thrown at the steel pillar might dent it slightly, but *if thrown at a tin which is made of thin steel, it will not break the tin but it will bend it*[23], and probably quite alter its shape or 'deform' it. If the stone hits a lead water pipe, the lead will bend too, even more than the tin. Steel and lead are quite *different* kinds of solid *from*[24] glass — they do not crack, but they *do*[25] bend, steel with difficulty and lead more easily.

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18. 例如. 等于 for instance. 19. 掷到桥梁钢柱上去. 过去分词短语作定语，修饰 a stone. 20. 除了或许打出一个小小的凹痕外. except for 除……以外； making a small dent 是动名词短语，作 except for 的宾语. 21. 对钢根本没有影响. 22. 它也不象钢那样会弯曲、会凹进一点儿. 23. 如果掷到薄钢制成的听子上，它(指石头)不会把听子打破，但会使它折弯. 在 if thrown at ... steel 这一条件状语从句中，主语和助动词 it is 省略. 一般说来，从句中省略的主语应该和主句中的主语相一致. 24. 与……不同. 25. 的确能. 助动词 do 用以加强语气，应强读.

Different solid substances, therefore, have different qualities. Some bend easily others are brittle. Solids such as iron and steel are very tough, whereas others, such as paper, cardboard, and most kinds of wood, are much less tough and can be cut and shaped quite easily. Engineers and manufacturers need to know very exactly *how hard, tough, brittle, or bendable any substance is*[26] when they are making things, especially things such as bridges or aircraft which have to *carry great weights or stand severe strains*[27].

The quality of a solid does not always remain the same. A lump of butter which has been in a cold refrigerator has a definite shape and is quite hard; but if it is left in a warm room it becomes softer and may begin to *lose its shape*[28]. If it is left near the fire, *so that it becomes very warm*[29], it will lose its shape altogether and become liquid. Most solids grow softer when they are heated. But very hard solids such as stone or iron do not become softer until they are very hot indeed, so in the everyday world around us we always find them hard and strong (see also Chapter 4).

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26. 名词性从句，作 need to know 的宾语。 27. 承载很大的重量或者经得起剧烈的应变。 28. 变形。 29. 这样黄油就会变得温热。so that 是连词，引导结果状语从句。

2. LIQUID THINGS *

The coldest land *on Earth*[1] lies round *the South Pole*[2]. It is a huge continent, *bigger than the whole of Europe and the U.S.A. put together*[3], and there is *nothing but*[4] ice and snow and a little bare rock on some of the mountains. Yet scientists are living there, studying the weather and examining the rocks that lie underneath the ice, and they stay *for months on end*[5]. If they want water for washing, or for drinking, then they have to gather snow or ice and heat it. As they heat it, *so*[6] it melts and *turns into*[7] water.

The same kind of thing happens with an ice-cream. When it comes out of the refrigerator it sits like a lump at the top of the cone. Sometimes it is round, sometimes almost square; but *in either case*[8] it is solid. Then as it becomes warmer and as you eat it, the ice-cream melts. As it melts, it turns into a milky liquid that runs everywhere unless you are careful.

Ice is quite hard and solid. During a very cold win-

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* 液体 1. 地球上。 2. 南极。 3. 比整个欧洲和美国加起来还要大。这里的 whole 是名词。注意：不可说 *the whole Europe，因为 whole 作形容词时后面习惯不跟表示地名或国名的专有名词；put together 把……加起来，是过去分词短语，作定语，修饰 the whole of ... U.S.A.。 4. 除了……以外什么也没有、只有。这里的 but 是介词。 5. 连续好几个月。on end 连续地。 6. 这里的 so 是多余的。 7. 变成。 8. 在(两种情况的)任何一种情况下。

ter, the water in a tank outside a house will be frozen, and the ice will be one large, solid lump. *If there is a tap at one side of the tank and it is turned on*[9], nothing will happen, because a solid lump cannot flow through the tap. But when the weather becomes warmer, the ice will melt and change to water. The water can take any shape, and does not keep in a solid block like the ice, so it will run through the tap and flow away.

Water is a liquid, and *all liquids take the shape of whatever is holding them*[10]. If water is poured into a glass with straight sides, it will fill the glass and have *the same* shape *as*[11] the inside of the glass. But if it is poured into a shallow cup or a basin, it will take the shape of the basin or the cup. The same thing happens with milk, or with tea, or with any other liquid. And if you spill water on the floor, *it runs all over the place, because it has nothing to make it keep a special shape*[12].

Water not only takes the shape of whatever its container may be — a glass, a cup, or a basin — but it also presses on the inside of that container *as if it is trying to escape*[13]. A good way of showing this is to fill a tall tin

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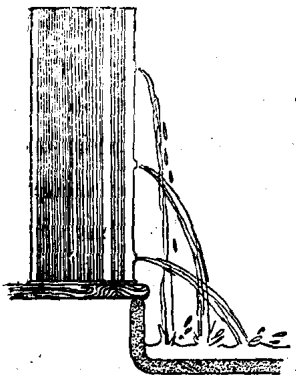
9. 如果容器的一边有龙头，而龙头是开着的。 10. 所有液体能形成任何盛放它们的容器的形状。whatever ... them 是名词性从句，作介词 of 的宾语。 11. 和……一样的。 12. 水就满地流，因为没有东西可以使它保持一个特定的形状。句中的 it 指 water; keep a special shape 是不带 to 的不定式短语，作宾语补语。 13. 好象它要逃脱（泄漏出去）似的。as if 好象，连词，引导方式状语从句。在现代英语中，在 as if 引导的从句中，也可用动词的陈述语气形式，表示并非虚构。



Water spurting from three holes at different levels

with water, *stand it by the edge of a sink or a bath*[14], and pierce three holes in it: one hole near the top, one in the middle, and one near the bottom. Water pours out from all three holes, but *it spurts out further from the middle hole than from the top one, and from the bottom hole it spurts out furthest of all, as the picture shows*[15].

The reason why the water spurts out further from the lower holes is because it is pressed out with a stronger push.[16] The push or pressure comes from the water that lies above, and *since more water lies above the middle hole than above the top one*[17], the water will spurt out further. And, of course, since there is more water lying above the bottom hole than above the other two, the pressure there will be the greatest, and the water will spurt out further still.

The pressure on the water is caused by the weight of the water. People do not always *think of water as weigh-*

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14. 把它竖放在洗涤槽或浴缸的边上。 15. 如图所示，中孔出来的水比上孔出来的水喷射得远些，下孔出来的水喷射得最远。as the picture shows 中的 as 是关系代词，表示整个主句的意思，相当于 the picture shows that .... 16. 为什么较低的两个孔中出来的水喷射得远些，理由是它被压出来时受到较大的推力。why the water ... holes 这一从句是主语 reason 的同位语。The reason ... is because ... 是非正式文体；正式文体用 The reason ... is that .... 17 因为中孔上面的水比上孔上面的水多些。

ing anything[18], but if you lift an empty bucket and then lift a full one, you immediately know that water is quite heavy. In the tin with holes in it, the pressure on the bottom hole is caused by the weight of all the water, but the pressure on the middle hole is caused by the weight of only half the water pressing on it; the top hole has very little weight at all above it, *and so the pressure there is least of all*[19].

If you take a tin of soup and punch one hole in the top, you will find that the soup does not *run out*[20]. Even if you *tip the tin upside down*[21], and the weight of all the soup presses on the hole, no soup will come out. Why? The reason is that *no soup can leave the tin unless something else can get in to take its place*[22]. But no air can get into the tin if there is only one hole because the soup is blocking the hole. If you punch another hole, then the soup will pour out easily from one hole, and air will enter by the other to take its place. If you *put a finger over the second hole*[23], then the flow will stop. This is *why a container must have two holes for it to pour properly*[24], and that is why there is always a hole in the lid of a teapot.

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18. 把水看作有多重. think of ... as 把……看作……. 19. 因此在所有的压力中那里的压力最小. there 指 on the top hole; least 前省略了定冠词 the. 20. 流出. 21. 把听子倒过来. upside down 颠倒、倒转. 22. 除非另外的一些东西进得去取而代之，汤是不会流出听子的. 23. 用手指按住第二个孔. 24. 为什么容器必须有两个孔才能使液体适当地不断流出. 这里的 it 指容器中的液体.

3. GASES *

In a wind everything blows about: tree branches, leaves, paper, and caps and hats. *Sometimes the wind is strong enough to blow down fences and trees and do a great deal of damage.*[1] Yet, *however strong it is*[2], we can never see the wind, we can only *feel it blowing against us*[3] and *see what it does*[4]. We cannot see the wind itself because *a wind is made by moving air*[5] (see Chapter 14), and we can feel and breathe air, but not see it.

Although we cannot see it, the air is spread out all around us, *filling up every tiny space and crevice*[6]. In a room, the air is everywhere: inside the cupboards, under the chairs, up in the corners of the ceiling, even underneath the carpet. The air is everywhere because it is a gas, and a gas, like a liquid, does not keep any special shape but spreads out in all directions. The air spreads right round the Earth, so that wherever we go on the Earth, we shall always find that there is air to breathe.

A good way of seeing how air fills up a space is to pump

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* 气体 1. 有时，风大得足以吹倒篱笆和树木，并造成很大破坏。do damage 损害、破坏。 2. 不论风多大。是让步状语从句。 3. 感到风在向我们吹来。blowing against us 是现在分词短语，作宾语补语。 4. 明白风在干什么。注意，这里的 see 不是"看见"的意思。 5. 风是由流动着的空气形成的(空气流动形成风)。现在分词 moving 修饰名词 air。 6. 充满着每个细小的空间和裂缝。现在分词短语作状语，说明主句的谓语部分。

up a bicycle tyre.[7] *Every time*[8] the handle of the pump moves out, air goes into the pump, and every time the pump handle moves down, the air in the pump is pushed into the tyre. As the pumping goes on, the tyre becomes fatter and rounder *as*[9] the air is filling up the space inside it. As it grows fatter and rounder, *so*[10] it grows harder, and gradually *it needs stronger and stronger pushes to work the pump*[11].

It becomes harder to work the pump because the air inside the tyre is being pressed tighter and tighter as we *pump in still more air*[12], and so we have to press harder to push it in. This is why the tyre becomes harder. *The more air there is inside the tyre, the harder it is pressed together, and so the harder it pushes on the inside of the tyre.*[13]

The pressing together or 'compression' of air can be very strong, as we can see if we blow up a balloon too far.[14] *To begin with*[15], the balloon is soft and shapeless; then, as the air is blown into it, it begins to *fill out*[16]: the air *takes up*[17] all the space inside, and the balloon turns into a

7. 要了解空气是如何充满空间的，其好方法是，给自行车轮胎打足气。 8. 每当。作连词用。 9. 这里的 as 作"因为"解。 10. 这里的 so 是多余的。 11. 使用打气筒(指打气)需要越来越大的推力。这里的 to work the pump 是真正的主语，前面的 it 是形式主语。 12. 打进更多的空气。这里的 in 是副词。 13. 轮胎内空气越多，压在一起越紧，因此对轮胎内壁的压力也越强。这里采用的是 the more ... the more ... 结构，意即"越……越……"，通常前者在含义上相当于一个条件从句，后者为主句。句中的两个 it 均指空气。 14. 空气压在一起即空气"压缩"，其力非常强大，如果我们把气球吹过头，就可以看到这一点。or 'compression' 解释前面的 the pressing together, or 作"即"解。句中的 as 是关系代词，指整个主句的内容。 15. 首先。 16. 变大。 17. 占据。