理工科英语阅读小丛书

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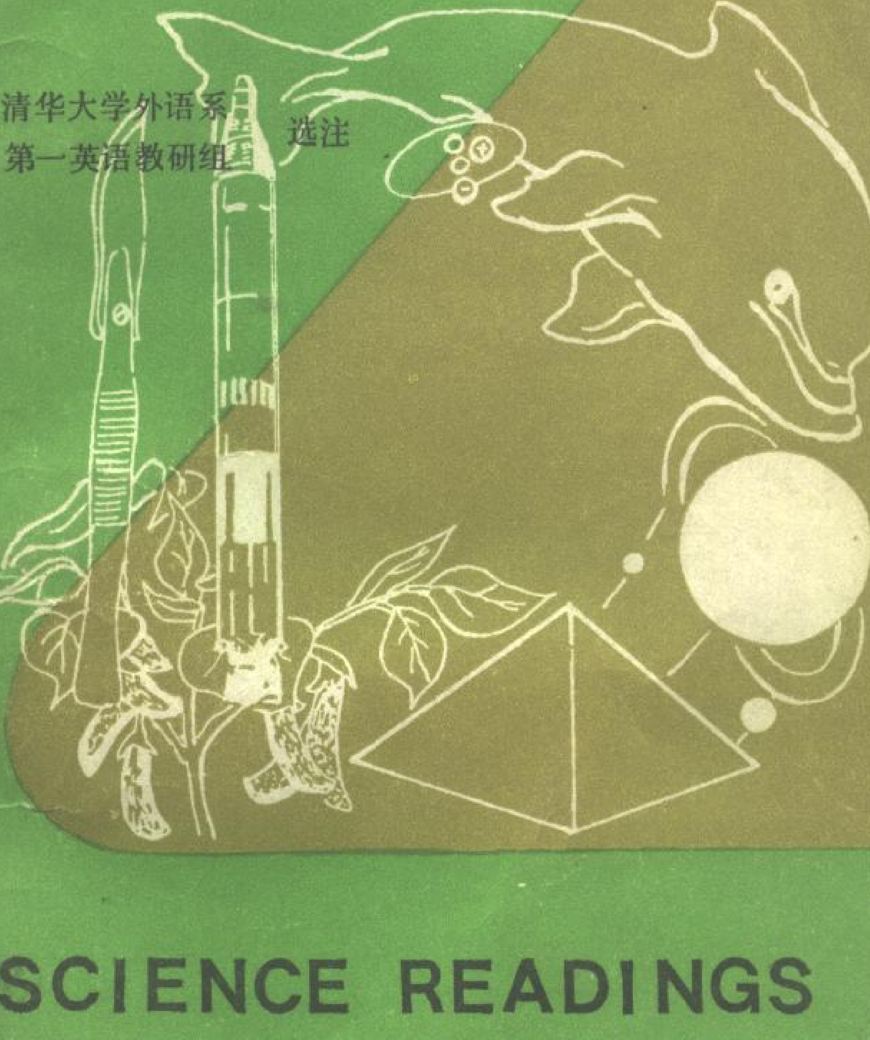
清华大学外语系
第一英语教研组 选注



SCIENCE READINGS

科普读物选

清华大学出版社

理工科英语阅读小丛书 (5)

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清华大学外语系第一英语教研组选编

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内 容 提 要

本书选自 Kenneth Croft 和 Billye W. Brown 所编写的"Science Readings"一书，内容涉及生物、物理、化学、地球物理、工程技术、数学、仿生学以及空间探索。本书词汇量比较丰富、语言流畅。适合理工院校二、三年级学生和其它工程技术人员阅读。

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前　言

在理工科大学的英语教学中，我们常常感到如何提高学生的阅读能力是一个不太容易解决的难题。现有的精读教材，由于篇幅和内容的限制，词汇量往往偏窄，各种语言现象的出现和重复受到极大的影响，这样就不利于培养学生的阅读能力。

学习外语必须通过实践，而阅读能力的培养和提高就更有必要通过大量的阅读实践。有了这种实践，才能积累和扩大词汇量，巩固已掌握的语言知识，并在此基础上进一步学习一些新的习惯表示法，从而提高阅读速度，增强理解力，为此，我们编选了一套理工科大学生英语阅读小丛书。在选材方面，我们尽量考虑到内容的知识性、科学性和趣味性。语言力求生动活泼，清新明快，简洁易懂。每册书后附有总词汇表，以利查阅和记忆。对某些难点作了适当的注释。本丛书共有十册，包括传记、小品、科普文选以及有关工程技术方面的文章。

本册由清华大学外语系主任李相崇教授审阅，李家卿、金世恒、徐君如、古秀玲等同志注释。

由于我们水平有限，缺点和错误在所难免，热切希望得到广大读者的批评和指正。

清华大学外语系
第一英语教研组

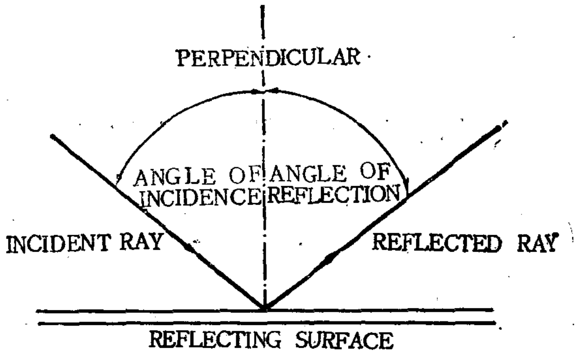
CONTENTS

1. The Bending of Light

The early Greek philosophers, *some*[1] 3,000 years ago, believed an object is visible to us because our eyes send out special rays, and when these rays strike an object and return to our eyes, we see the object. Today we know that our eyes do not send out rays; our eyes receive rays emitted by the object. *These rays are of two types:*[2] (1) direct light, which we receive from a light source such as the sun; and (2) indirect light, which is reflected, just as this page reflects the light *by which you are reading*[3]. A body that produces its own light waves, like the sun or an electric bulb, is said to be luminous, while a body that reflects light, such as the moon or this page, is said to be illuminated. Thus, any object that sends light waves toward our eyes is visible.

How Light Waves Are Reflected

Reflections *such as those seen in a mirror, or on a polished table or in the glass of a window,*[4] exist because the light waves strike these surfaoes and *bounce off*[5] *in much the same manner as a ball bounces when thrown against a wall.*[6]



Light travels in a straight line. We *make use of*[7] this fact when we want to make light turn a corner; this is done by reflection. The periscope, similar to that used in a submarine, makes use of the principle of reflection. Light is made to change its normal straight-line course *by being reflected*[8] off a mirror or some other special surface. It is possible to control the direction of the reflected light, because we know the "*Law of Reflection*.[9]" According to this law or rule, if a light wave strikes a surface (from which it will be reflected) at an angle, it will "bounce off" at an angle. The light wave that strikes the surface is known as the *incident ray*[10]. The angle between the incident ray and a perpendicular *drawn to the surface*[11] is known as the *angle of incidence*.[12] The light wave that has bounced off the reflecting surface is called the *reflected ray*[13], and the angle between this ray and the perpendicular is known as the *angle* *of reflection*[14]. In every case the angle of incidence *is equal to*[15] the angle of reflection.

Diffused Reflection[16]

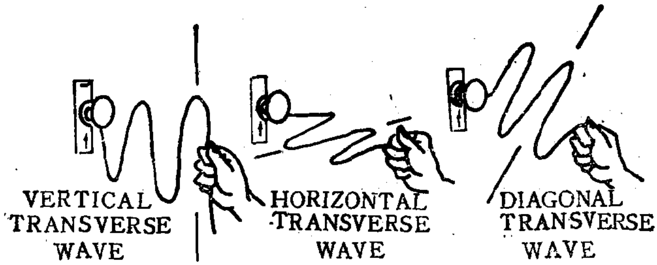
The Law of Reflection is true under all conditions, whether the surface is smooth, like a mirror, or rough, like a sandy beach or a brick wall. If you take a flashlight on a moonless night and point it at the very smooth wood exterior wall of a house, the light will be reflected. If the light is aimed at an angle to the wall, the angle of incidence will be equal to the angle of reflection.

However, when a light strikes a rough surface, the light is diffused. The reason the light from the flashlight will not bounce off a rough brick wall, *as it does*[17] from a smooth wooden wall, is that the light is sent off in different directions by the uneven surface of the bricks. Yet if we could examine each *minute*[18] portion of light—*break down*[19] the beam into many individual light waves—we would find in each case that the Law of Reflection still works. But because the surface consists of many small portions at different angles, each small light wave is reflected in a different direction.

When Light Waves Bend

Light waves travel through space and various kinds of materials. When these waves can pass through a certain material, we say that the material is transparent. But light does not travel at the same speed through all materials; it goes slower through *some*[20] than through others. While light waves travel most quickly through air, they go much slower through water and even slower through glass. When the light waves, traveling through air, strike water or glass at an angle, they bend as they slow down. When light passes from one transparent medium (such as air, water, or glass) to another at an angle, the waves are bent at the boundary between the two mediums. This bending is known as refraction. You can see this easily if you put a straw into a glass of water. The straw seems to be bent at the place where it enters the water. There is always some moisture in the atmosphere, but when this amount increases a great deal. it affects the light waves. Light traveling through space goes at a much faster speed than light waves *passing through very moist air near the surface of the earth*[21]. Space and moist air are considered by scientists as two different mediums, just as water and glass are different. And just as light waves are refracted as they pass from air into glass or water, the light waves from space are refracted when they pass through the moist air.

You can see this refraction *at work*[22] if you watch



the sun setting on a very damp, warm day. Just as the sun nears the horizon, the previously round disk seems to have a flattened bottom; it is not a perfect circle. The light waves coming from the bottom portion of the sun are refracted by the moisture in the air to create this illusion.

Polarized Light

One of the properties of light is that it travels in the form of waves as it goes from one place to another. Light travels as a series of crests and troughs much like a wave in water. We can create such waves with a piece of string or rope. If you tie one end of the string to a door handle and hold the other end in one hand, you will be able to produce a wave by moving your wrist up and down. This type of wave, moving up and down, is known as a *vertical transverse wave*[23] because it vibrates in a vertical plane, an imaginary vertical surface. *On* *the other hand*[24]. if you move your wrist from side to side, you produce another type of wave; it is known as a *horizontal transverse wave*[25]. vibrating in a horizontal plane. Now, still holding the rope, you can move your wrist along a diagonal—to the right as you go up and to the left as you go down. This will produce another type of wave different from either the vertical or horizontal transverse wave.

We know that light is a combination of several kinds of waves. It travels as horizontal transverse waves, vertical transverse waves, and many types of *diagonal transverse waves*[26]. *In effect*[27]. it is a combination of waves, each flowing in a different plane. If we separate any of these waves, that is, *single out*[28] one wave in a given plane, we have polarized the light wave.

We can polarize light waves by using special materials or lenses. These materials consist of millions of small crystals shaped like needles and they permit only those light waves *that vibrate parallel to a certain plane to pass through the material.*[29] Light waves *perpendicular to*[30] that plane are adsorbed by this material. The material used is known as a polarized lens. Normally, polarized lenses are used *in pairs.*[31] Light coming through the first lens can pass through the second lens if they are *lined up*[32] so that light waves coming through both lenses are parallel to the same plane. Then if the second lens is rotated 90°, the second lens will absorb all the light that has passed through the first lens. Thus, no light will be able to come through the pair of lenses.

Our eyes cannot tell the difference between polarized or nonpolarized light waves. Yet, when we take photographs and want to eliminate unwanted reflections, such as the reflection from the glass in a picture frame, we use polarizing lenses to do this job. Similarly, when we are observing an object under a microscope, we can eliminate the unwanted reflections which may occur. Again, we use polarizing lenses to do the job. Also, polarized glass used for windshields of cars reduces the glare from the sun and from the headlights of other cars.

Notes

1. 副词，等于about。
2. 译为："这些光线是两种类型的"。
3. 是修饰light的定语从句。
4. those 代reflections; seen…window 是过去分词短语作定语，修饰those。
5. "弹起"。
6. 译为："很象把球掷向墙壁时球弹起来一样"。in much the same manner: 以大体上与……相同的方式。when thrown＝when a ball is thrown。
7. "利用"。
8. being reflected 是动名词的被动形式作介词by的宾语。

9. "反射定律"。
10. "入射线"。
11. 分词短语作定语，修饰perpendicular(垂直线)。
12. "入射角"。
13. "反射线"。
14. "反射角"。
15. "等于"。
16. "漫反射"。
17. does 代替前面的 bounce off；not…as：不象……那样地……。
18. "微小的"。
19. "把……分解为(into)…"。
20. 等于some materials。
21. 现在分词短语作定语，修饰 light waves。
22. "在起作用"。
23. "垂直横波"。
24. "另一方面"。
25. "水平横波"。
26. "斜向横波"。
27. "实际上"(=in fact)。
28. "挑选出"。
29. that vibrate…material：是修饰 light waves 的定语从句；parallel to：平行于。
30. "垂直于"。
31. "成对地"。
32. "(使)排列起来"

2. Sounds You Cannot Hear

About a mile off the coast of England a small ship moves slowly back and forth. After a few hours of going to the left and then to the right, to the left again and then to the right again, a buoy is ***thrown overboard***[1] and the ship returns to port. The wreck of a sunken ship has just been located by sonar. Later, divers will go down to examine the wreck and to decide how to raise it from the bottom of the sea.

Uses of Sonar

"Sonar" is the name put together from "*SOund NAvigation and Ranging*."[2] It uses high-frequency sound waves to measure ocean depths. An instrument on shipboard called a fathometer, using an electrical vibrator, sends a short blast of sound into the water. The waves ***produced***[3], traveling at about 4,800 feet a second, hit the ocean bottom and bounce back to a microphone on the ship. The time between the sending of the blast and the return of the echo is marked automatically on a moving strip of paper. With this information the distance to the bottom can be determined easily. Besides measuring ocean depths and locating underwater objects such as sunken ships, *schools of fish*[4], and enemy submarines, sonar helps in ocean navigation. Radar uses short radio waves to locate objects in air or in space *in much the same way*[5]. But radio waves do not pass through sea water, while sound waves can do this easily.

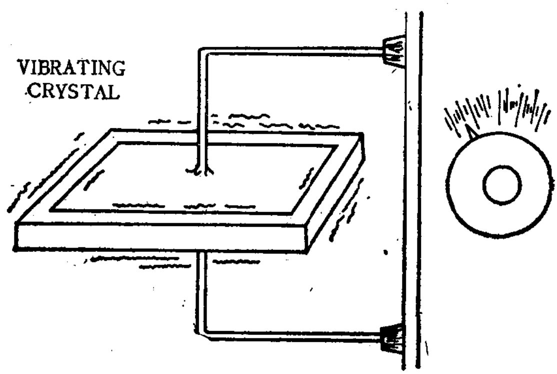
Sonar is just one of the uses that engineers and scientists have found for ultrasonic sound, which is often called ultrasound. These are names for sound that *is too high in frequency to be heard*[6]. *The average person*[7] can hear sound waves that range in frequency from about 20 to 18,000 vibrations per second. A dog can hear vibrations as high as 40,000, and the hearing range of other animals *goes even higher*[8]. The waves used in sonar have a frequency of around 25,000.

Production of Ultrasounds

For most of the practical uses of ultrasound, the waves have frequencies from about 20,000 to 1,000,000, although frequencies as high as 10,000,000,000 (ten billion) have been produced in laboratories. Ordinary sound waves are usually a few feet long, but ultrasonic waves are measured in tiny fractions of an inch. The very short wave lengths of ultrasound make a great difference in what they can do.

Vibrating strings, *organ pipes*[9], or loud-speakers are useless for the production of ultrasounds because they are much too slow. So special electrical instruments had to be invented. One kind of ultrasound generator uses a thin slice made from a *crystal of quartz*[10]. The slice is held between two flat pieces of metal connected to a special radio set. When the electric current surges *back and forth*[11], it makes the crystal vibrate. The sides of the crystal move in and out like the air in an organ pipe, but at much higher frequencies. This movement sets up waves of ultrasound in the air or other surrounding material.

Ordinary sound waves usually spread out in all directions, but ultrasonic waves, being much shorter, can be sent out in a straight beam. This makes it possible to pack a great amount of sound energy into a small space. The high frequency also helps *toward putting out more energy*[12].



An experimenting scientist attached a thin fiber to a vibrating quartz crystal. On the end of this fiber he placed a drop of oil, which was instantly changed into a little cloud of mist. Snails and small fish could be killed by putting the vibrating crystal into an aquarium. These experiments were exciting stunts when scientists first began to experiment with ultrasound about thirty years ago, but the really important uses came later.

Ultrasonic Waves in Liquids

Today, ultrasonic waves are being put to work in laboratories and factories. If an ultrasound generator is placed in a liquid, the waves move the liquid back and forth hundreds of thousands of times each second. This causes materials to mix quickly or to dissolve in liquids. Paint manufacturers use ultrasound to do a better job of blending colors. The companies that make film for your camera find that mixing chemicals by the use of sound waves will produce a more sensitive film.

The new lightweight type of *washing machine*[13] uses ultrasonic waves to get clothes clean. Its special ultrasound generator is put into a pail of soapy water containing the soiled clothes. The sound waves drive the soapy water back and forth through the cloth so fast that everything is soon clean. There is