BASIC SCIENCE SERIES — BOOK 6

自然科学初级读物 — 第 6 册

LIGHT

光

徐烈成　译

吴延迪　校

阎玉仲　插图

胡焕然

科学普及出版社

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INTRODUCTION

Blindfold yourself and try to move around in the classroom. Will you be able to do this? You will probably fall over a chair or walk into the wall. You feel helpless when you try to move about in the dark. Now do you see how important light is? Close your eyes and think about what it would be like to live in a world where there is no light.

With the help of a magnifying glass you can make use of light from the sun to light a match or burn a piece of paper. This shows that light is a form of **energy**.

HOW LIGHT TRAVELS

How does light travel? Does it travel in a straight line? Or does it travel like water, flowing around objects blocking its path? We can find this out very easily.

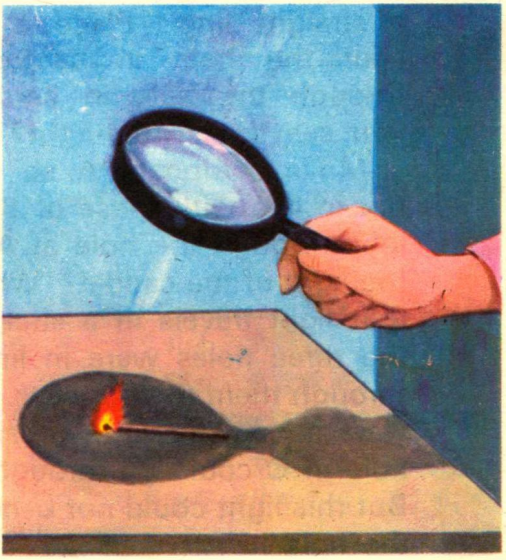
引　言

把眼睛蒙住，试在教室里走走看，能行吗？你可能会被椅子绊倒，或者撞在墙上。当你想在黑暗中走动时，你会感到寸步难行。现在你明白光是多么重要了吗？闭住眼睛想一想，生活在一个没有光的世界上将会是什么样子。

借助于放大镜，你就能利用太阳光点着火柴或点燃纸片。这说明光是能的一种形态。

光是怎样传播的

光是怎样传播的呢？光是直线传播，还是象水那样绕着流过阻挡其去路的物体而传播呢？我们能毫不费劲地找到答案。



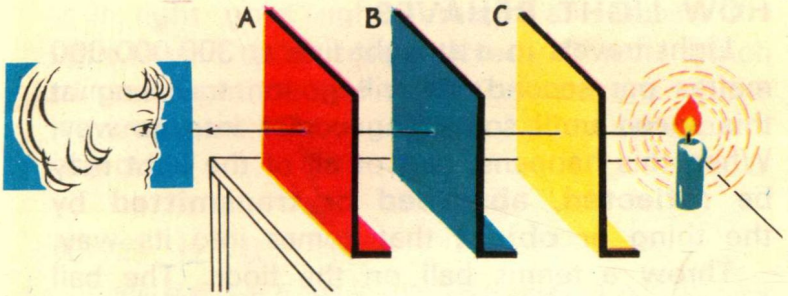
Light is a form of energy.

光是能的一种形态

Things to Do

Cut three pieces of cardboard A, B and C. Each piece should be about 25 cm square. Draw diagonals on each of the square cardboards. At the point where the diagonals on each cardboard cut, make a very small hole with a pin. Now fix each piece of cardboard on a wooden stand and place it on a table. Place the pieces as shown in the picture. Pass a string straight through the holes. Pull the string taut so that the holes are all in a straight line. Place a lighted candle near the hole in cardboard C. Look through the hole in cardboard A. Can you see the candle-light?

Move cardboard A so that its hole is not in line with those of B and C. Again, look through the hole at A. Can you see the light of the candle? Why? This shows that light travels in a straight line. When the three holes were in line, light passed through them to your eye. When the holes were not in line, light passing through the hole in C could go through the hole in B. But this light could not bend to go through the hole in A.



To show that light travels in a straight line

证明光以直线传播

动 手 做

剪三张纸板：A、B和C，每张纸板应为25厘米左右见方。每张方纸板上画上对角线，在对角线交叉点上用大头针扎一个很小的孔，然后把每张纸板分别固定在木座上，放在桌上。按图所示把三张纸板排列在桌上。用一根线径直穿过三张纸板的小孔。把线拉紧，使三个小孔都处于一直线上。在靠近纸板C的小孔处放一支点着的蜡烛。透过纸板A的小孔观看，你能看见烛光吗？

移动纸板A，使它的小孔不与纸板B和C的小孔成一直线。再透过A上的小孔观看，你能看见烛光吗？为什么？这说明光是直线传播的。刚才三个小孔成一直线时，光就通过小孔射到你的眼睛。小孔不成一直线时，从C板的小孔透过来的烛光能穿过B板上的小孔，但不能拐弯穿过A板的小孔。

HOW LIGHT BEHAVES

Light travels in a straight line at 300,000,000 metres per second. It will go on travelling at this speed until something comes into its way. When this happens, part or all of the light may be **reflected**, **absorbed** or **transmitted** by the thing or **object** that comes into its way.

Throw a tennis ball on the floor. The ball bounces back. In the same way, when light falls on certain things it bounces back. When this happens, the light is said to be **reflected**. This can be clearly shown when you shine a beam of light from a torch at a mirror in a dark room.

Some objects do not allow light to go through them. If light is not completely reflected by the object, some light is said to be **absorbed**. Things that do not allow light to pass through are said to be **opaque**.

transparent
透明体

If light goes right through an object, the light is said to be **transmitted**. Objects which transmit light are said to be **transparent**. Glass is transparent. Do you know of other transparent objects?

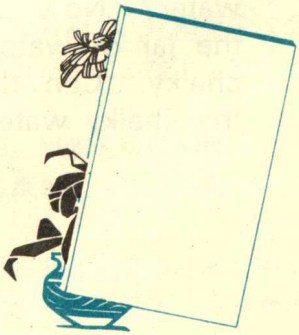
光 的 性 状

光以每秒三十万公里的速度沿直线传播。光会一直以这样的速度传播，除非有什么东西挡住它的去路。出现这种情况时，一部分光或全部光就可能被挡住其去路的东西或物体**反射**、**吸收**或**透射**。

将网球扔到地板上，球会弹回来。同样，光照到某些物体上时也会弹回来。这种情况叫做光受到**反射**。你在暗室里把一道手电光照射到镜子上时，这种反射现象就非常明显了。

有些物体是不透光的。如果光未被物体全部反射，那就叫做有些光被**吸收**了。光透不过的物体称为**不透明体**。

如果光直接透过某物体，就叫做光得到**透射**。能透射光的物体叫**透明体**。玻璃就是透明体。你还知道别的透明体吗？



opaque

不透明体

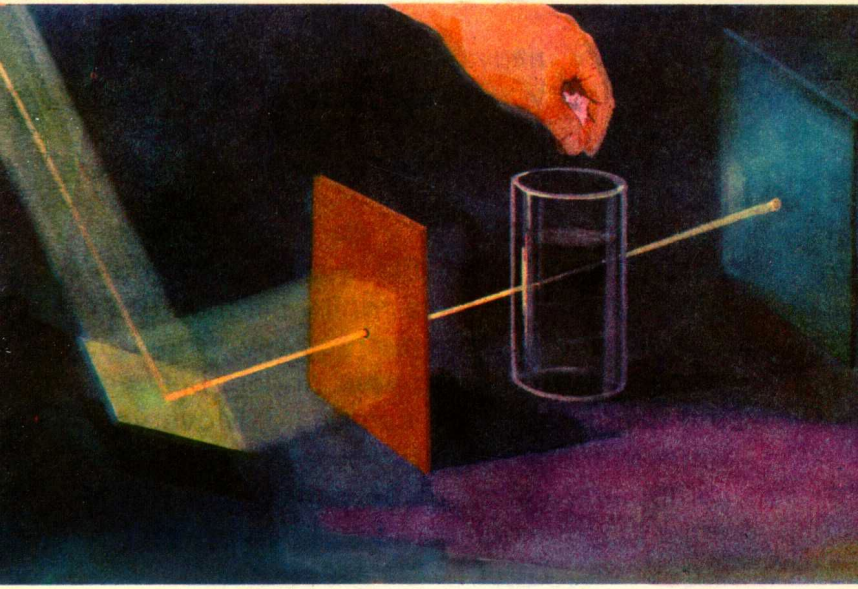
You have learned that light can travel through air. Now let us see whether it can travel through water.

Things to Do

You will need a piece of cardboard with a hole in the centre. The hole should be large enough for a pencil to go through. Next, with a mirror, reflect sunlight in such a way that the sunlight goes through the hole in the cardboard. Let the spot of sunlight fall on a book, on the wall, on the ground or on your clothes.

Look at the spot of sunlight. The sunlight first fell on the mirror. The mirror reflected the sunlight which passed through the hole in the cardboard. It fell on your book as a spot of sunlight.

Now place a jar of clear water between the cardboard and the spot of sunlight. Can the sunlight pass through the jar of water? Now place some chalk dust in the jar of water so that the water turns chalky. Can the sunlight pass through the chalky water?



你已经了解光能够通过空气传播。现在让我们看看，光是否能通过水传播。

动 手 做

你得有一张纸板，其中心处开一孔，大小须能穿过一支铅笔。然后用一面镜子反射阳光，使阳光透过纸板上的孔。让这一太阳光点照射到书上、墙上、地上或你的衣服上。

观察这一太阳光的光点。阳光先照射到镜子上。镜子再将阳光反射出去，穿过纸板上的孔，阳光在书上成一光点。

现在把一瓶清水放在纸板和太阳光点之间。阳光能透过这瓶水吗？再在瓶子里撒一些粉笔灰，使水变浑。阳光能透过浑水吗？

SHADOWS

We can see many shadows of objects all around us. Do you know how shadows are formed? Let us find out.

Things to Do

You can do this in a dark room or you can do it at night. Place a lighted candle on a table and fix a white cardboard on a wall about one metre away from the candle. Now bring your fingers between the candle and the cardboard. Move your fingers about. What do you see on the cardboard? Instead of using hands, use other opaque objects such as shapes cut out from cardboard pieces.

Hold the object in a fixed place. Move the candle nearer to and then further away from the cardboard. What happens to the shadows when you do this? Now leave the candle in a fixed position, but move the object nearer to and then further away from the cardboard. What happens?

Light from the candle falls on the cardboard. When an object is placed between the candle and the cardboard, a black shape of the object appears on the cardboard. The light from the candle falls on the object but cannot pass

through it. This means that no light will fall on the cardboard and therefore that part of the cardboard looks dark. This dark shape is called a **shadow**. When the candle or object is moved the shadow becomes bigger or smaller.

影　子

我们能在四周围看到许多物体的影子。你知道影子是怎样形成的吗？让我们来找出这一答案。

动　手　做

你可以在暗室里或晚上做这一实验。把一支点着的蜡烛放在桌上，在离蜡烛约一米远的墙上钉一张白纸板。现在将你的手指放在蜡烛和纸板之间。动动手指，你在纸板上看到了什么？然后，不用手，而代之以别的不透明的物体，如剪成不同形状的纸板。

把这个物体放在一个固定的位置上，将蜡烛移近纸板一些，然后再移远一些。你这样做时，墙上的影子会出现什么情况？现在，把蜡烛放在一个固定的位置上，而将物体移近纸板一些，然后再移远一些，又会发生什么情况？

来自蜡烛的光射到纸板上。当蜡烛和纸板之间放着一物体时，纸板上就会出现这一物体的黑色形状。烛光射到物体上，但透不过去。这就是说，光射不到纸板上，所以纸板上的那一部分看起来就是黑的。这黑色的形状就叫**影子**。当蜡烛或物体移动时，影子就会随之变大或变小。

COLOURS OF LIGHT

Natural light or 'white' light is actually made up of many colours. Have you seen a **rainbow**? We can see rainbows after a rain. They are formed when sunlight passes through small drops of water in the sky. Next time you see a rainbow, try to make out the different colours. You should be able to name seven different colours.

Things to Do

We can find out how the colours in the rainbow are formed by doing this. Pour some water into a basin. Cut a piece of black paper so that it can cover the top of the basin completely. Fold the round piece of black paper into half and unfold it. On one half, cut a narrow slit. On the other half, cut a round hole and paste a piece of tracing paper on the black paper to cover this hole. Do not cover the slit.

光 的 颜 色

自然光或“白”光实际上是由许多颜色组成的。你见过彩虹吗？我们可以在雨后见到彩虹。彩虹是阳光透过天空中的小水滴时形成的。下次你看到彩虹时，设法把它的各种颜色辨别出来。你应该能说出七种不同的颜色。

动 手 做

通过下面的实验，我们能发现彩虹的颜色是怎样组成的。在盆里倒些水。剪一张黑色的纸，大小须能把盆口完全盖住。把这张圆形黑纸对折后再摊开，在这半面剪一个狭长切口，在那半面开一个小圆孔，并在黑纸上贴一张描图纸将圆孔盖住。不要盖住切口。

Next, place a mirror at the bottom of the basin. The silver side (the reflecting side) of the mirror must face upwards. Cover the top of the basin with the piece of black paper you have made. Hold it in place with adhesive tape or glue. Now move the basin to a place near a window where sunlight is coming in. Place the basin so that the sunlight goes into the basin through the slit. Roll another piece of black paper into the shape of a cylinder. Place this over the circular piece of tracing paper. Look through it. What do you see? Are the colours the same as those found in a rainbow?

The band of coloured lights you saw is called the **spectrum**. The seven colours are red, orange, yellow, green, blue, indigo and violet. Where do the colours of the spectrum come from? The colours are from sunlight. Therefore white light is not really white but is actually made up of the colours of the spectrum.

MAKING COLOURS WHITE

The colours of a rainbow can be obtained by breaking up white light. Is it possible to combine these colours into white light? We can find this out easily.

Things to Do

Get a round piece of cardboard. Cut a piece of white drawing paper of the same size. Carefully paste the piece of white drawing paper on the cardboard. Divide the circle into seven equal parts. Using water colours, paint each of the parts with one colour of the rainbow. Make sure that the colours are in the order that you see in a rainbow.

然后，在盆底放一面镜子，镜面（反射面）必须朝上。用你剪好的那张黑纸把盆口盖上，并用胶带或胶水粘住。然后，把盆移到有阳光射入的窗户附近，让阳光通过切口射进水盆。再用另一张黑纸卷成圆筒，放在那块圆形描图纸上面，通过圆筒观看。你看到了什么？看到的颜色是否与彩虹的颜色一个样？

你刚才看到的彩色光带叫**光谱**。这七种颜色是红、橙、黄、绿、蓝、靛和紫。光谱的颜色是从哪里来的呢？来自太阳光。所以白光并不真的是白色的，实际上是由光谱中的各种颜色组成的。

彩 色 变 白

将白光分解，就可得到彩虹的各种颜色。那么，能否将这些颜色合成为白光呢？我们能够轻而易举地找到这一答案。

动 手 做

找一块圆纸板。剪一张同样大小的白色绘图纸，把它仔细地贴在纸板上。把圆纸板分成七等分。用水彩颜料把每一等分涂上彩虹的一种颜色，颜色的顺序必须与你在彩虹中所看到的一致。

Now make a hole in the centre of the board and fit the point of one arm of a pair of dividers into it. Hold the board in a flat position with your dividers. The coloured side should face upwards. Now spin the board with your other hand. Keep it spinning. What is the colour of the spinning board?

When the board was spinning slowly, you could see all the different colours. When it was spinning very fast the board looked white. You could not see any of the colours.

现在在圆纸板的中心扎一个孔，把两脚规的一只脚尖插入小孔，拿着两脚规，并使纸板保持水平位置，涂上颜色的一面须朝上。然后，用另一只手转动纸板，使它不停地旋转。这块旋转的纸板呈现出什么颜色？

这块纸板慢慢旋转时，你能看出各种不同的颜色。纸板迅速旋转时，就成了白色，你就看不出其他颜色了。