

BASIC SCIENCE SERIES
自然科学初级读物

3

ELECTRICITY

电

吴永礼

译



科学普及出版社

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出 版 说 明

当前，在实现四个现代化的新长征途中，广大青少年正在努力学习现代科学文化知识，为祖国的社会主义建设事业，增长才干，积蓄力量。编译出版《自然科学初级读物》的目的，就是为初学自然科学和英语的读者，提供一套浅近而有趣的参考书籍。

全套读物共有16个选题，细目见各书封底。英语部分采自FEP INTERNATIONAL PRIVATE LIMITED出版的BASIC SCIENCE SERIES（修订版）。

为了便于阅读，对全书重新作了编排，绘制了插图，并附了参考译文。书中还配有相当数量的简单实验，使读者通过实验，加深理解有关科学内容。

由于编者水平所限，错误不当之处在所难免，请批评指正。

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BASIC SCIENCE SERIES—BOOK 3

自然科学初级读物—第3册

ELECTRICITY

电



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科 子 普 及 出 版 社

INTRODUCTION

If you look up at the ceiling in your house or classroom, you will find bulbs in a lamp shade or fluorescent tubes. What are they used for? They are used to light up the room. Whenever the classroom is dark, your teacher switches on the light and the room is bright again. Have you ever wondered what causes the bulb or the tube to light up? They need electricity to light up. Electricity passes through the wires that are attached to them and this makes the bulbs and tubes glow. When they glow, they give off light. That is how we get light from electricity. Can you think of other ways in which electricity is used in your classroom, in your home or elsewhere?

引 言

如果你抬头看你屋里或教室里的天花板，你会发现灯罩里的灯泡或日光灯管。它们是做什么用的呢？它们是用来照明房间的。每当教室里暗了，你们的老师就把灯打开，房间又明亮了。你曾经想知道是什么东西使灯泡或灯管发光的吗？它们需要电来发光。电通过连接在灯泡或灯管上的电线，使它们炽热。炽热时，它们就发出光来。我们就是这样从电得到光的。你能想得教室里、家里或别的地方利用电的其他方法吗？

WHAT IS ELECTRICITY?

All things are made up of very tiny particles called **atoms**. Metals, wood, glass, water and gases are made of atoms.

We cannot see atoms because they are very, very small. However, scientists have found out that even atoms are made up of smaller particles. One type of particle is known as the **electron**. Another type of particle is known as the **proton**. Yet another type is known as the **neutron**.

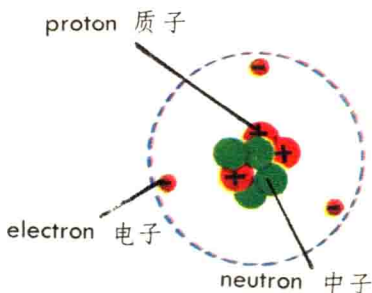
电 是 什 么

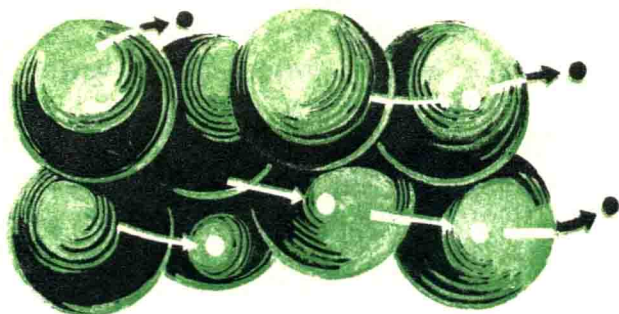
所有的东西都由很小的叫做原子的粒子所组成。金属、木材、玻璃、水和气体都由原子组成。

我们看不见原子，因为它们非常非常小。但是科学家已经发现，连原子也是由更小的粒子组成。有一种粒子叫做电子，另一种粒子叫做质子，还有一种叫做中子。



atoms 原子





Electricity is the flow- 电是电子的流动
ing of electrons.

Electrons have **negative charges**. Protons have **positive charges**. Neutrons have no charges.

When charges move, we get an **electric current**. An electric current consists of a movement of negative charges.

The charges that flow through the electric wire are electrons. The flow of electrons gives us electricity.

电子带负电荷。质子带正电荷。中子不带电荷。
电荷移动时，我们就得到**电流**。电流是由负电荷移动形成的。

流过电线的电荷是电子。电子的流动供给我们电。

HOW ELECTRICITY TRAVELS

Electricity travels along a path. If the path is blocked, then electricity cannot keep flowing. The whole path along which electricity travels is known as a **circuit**. Let us see how electricity travels.

电是怎样传导的

电沿着一条通路传导，如果通路被阻塞，电就不能继续流动。电所流过的整个通路叫做**电路**。让我们看看电是怎样传导的。

Things to Do

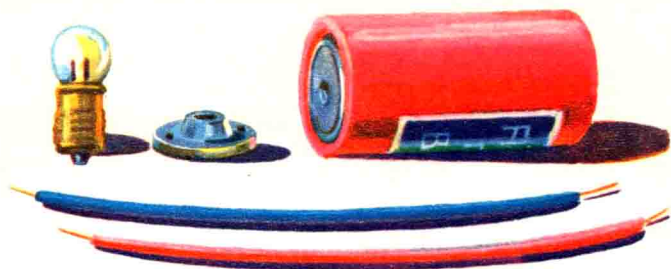
You will need the materials shown below. We are going to light the bulb. Connect your materials as shown in the picture on the next page. Use adhesive tape to stick the free end of each wire to the battery.

What happens when you have finished your connections? Does the bulb light up?

动手做

你要有下图所示的几种材料。我们将把灯泡点亮。将你的材料按下一页的图示连接起来。把每根导线的空着的末端用胶带粘在电池上。

当你把线接好后，出现什么现象？灯泡点亮了吗？



With your finger trace the path of the electricity from one end of the battery to the other. Where does the path end? Is the path broken? An unbroken path travelled by electricity is known as a **closed circuit**.

Disconnect one of the wires. Again trace the path of the electricity.

Is the path of electricity broken? Does the bulb light up? Is there electricity in the circuit?

A broken path is known as an **open circuit**. Electricity will not flow in an open circuit.

从电池的一端到另一端，用你的手指探测这条电的通路。通路在哪里终止？通路断没断？电所流经的一条不断开的通路叫做闭合电路。

拆开其中一根电线，再探测一下电的通路。

电的通路断开了吗？灯泡发光吗？电路中有电吗？

一条中断的通路叫做断开电路。电不会在断开电路中流动。



CONDUCTORS AND INSULATORS

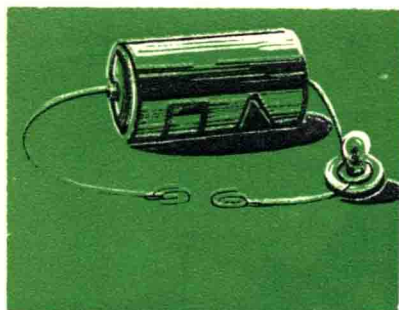
Some materials allow electricity to flow through them easily. Some materials do not. The materials that allow electricity to flow through them easily are known as **conductors**. The materials through which it is difficult for electricity to flow are known as **insulators** or **non-conductors**.

Let us test and see which are the materials that are conductors and which are the materials that are insulators.

导体和绝缘体

有些材料允许电顺利通过，有些材料则不。允许电顺利通过的材料叫做导体。电难于通过的材料叫做绝缘体或非导体。

让我们试验一下，看看哪些材料是导体，哪些材料是绝缘体。



A testing circuit

检验电路

Things to Do

Set up the circuit as shown in the picture.

Connect a paper clip to each of the free ends of the wire. Touch the two paper clips together. The bulb lights up. This shows that electricity is flowing through the circuit.

Separate the two clips. The light goes off. This means that the circuit is broken.

This kind of circuit which is used to find out whether or not electricity passes through a substance, is called a **testing circuit**.

Place a nail between the clips. Make the clips touch the nail. Does the bulb light up?

If it does you know that it is a closed circuit. This means that electricity is flowing through the nail. Hence the nail is a conductor. It conducts electricity.

动手做

按图所示组装电路。

在电线空着的那头各连接一只回形针。将两只回形针碰到一起，灯泡就亮了。这表明电在电路中流动着。

把两只回形针分开，灯就灭了。这表示电路断开了。

这种用来查明电是否通过某种物体的电路叫做检验电路。

在两只回形针之间放一只钉子。使两只回形针接触钉子。灯泡亮吗？

如果灯泡亮了，你就知道它是一个闭合电路。这表示电在流过钉子。因此，钉子是一种导体，它传导电。



Place a piece of chalk between the clips. Make the clips touch the chalk. Does the bulb light up?

If it does not, you know that electricity cannot flow through the chalk. Then the chalk is an insulator. It does not conduct electricity.

Repeat the experiment using a wooden ruler, a piece of glass, a metal spoon, a coin, a piece of paper, a pin, a plastic comb, a key, a pencil, a tin lid and a rubber eraser.

Separate them into conductors and insulators. What do you notice about the conductors? Are they all metals? Are all the non-metals insulators?

Conductors are useful to us. They allow electricity to flow through them. They can form a closed circuit.

Sometimes we do not want electricity to flow into certain things. We use insulators to prevent electricity from flowing to these things. We use rubber or plastic insulators to cover electric wires in order to prevent electricity from flowing into our body. Otherwise we will get an electric shock. So we can say that insulators are also very useful to us.

在两只回形针之间放一支粉笔。使两只回形针接触粉笔。灯泡亮吗？

如果不亮，你就知道电不能流过粉笔。因此，粉笔是一种绝缘体，它不传导电。

再用一把木尺、一片玻璃、一把金属匙、一枚硬币、一张纸片、一枚大头针、一把塑料梳子、一把钥匙、一支铅笔、一个铁盒盖和一块擦字橡皮，来做这个实验。

将它们区分为导体和绝缘体。你注意到导体有什么特点吗？它们都是金属吗？非金属都是绝缘体吗？

导体对我们是有用的。导体允许电流通过，能组成闭合电路。

有时我们不想让电流入某些物体，就利用绝缘体阻止电流入这些物体。我们用橡皮或塑料绝缘体包住电线，以阻止电流入我们的身体，否则就会触电。所以，可以说，绝缘体对我们也是很有用的。

HOW TO TEST FOR HIDDEN CIRCUITS

We can use the testing circuit we made earlier to find out about some other circuits which we cannot see. It is fun to find out what the results will be.

怎样检查出隐蔽的电路

我们可以用前面做成的检验电路来找出我们看不见的一些别的电路。看看结果如何是很有趣的。

Things to Do

First of all we have to make an **octopus box**. An octopus box is one which contains a circuit inside.

Take an open chalk box. Now use a paper binder and pierce it through the wall of the box. Let the paper binder stay firmly to the wall by twisting the metallic strips as shown. Repeat the same procedure using a few more paper binders on different sides of the box. Connect a few pairs of the binders by wire. Close the box with a lid. What you can see now is a closed box with the heads of the paper binders stuck to the walls outside. The heads of the paper binders are called terminals.

How to make an octopus box

怎样做线路盒



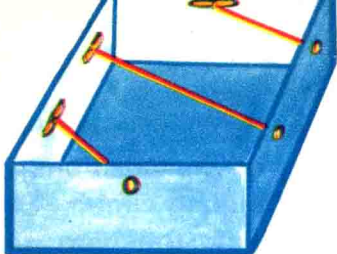
Turn your box round another way. Draw a diagram showing the positions of the terminals. Use your testing circuit. See whether it is working by touching the clips together. The next step is to let the clips touch any pair of terminals. Is there an electric current passing through the two terminals? If there is, draw a line joining the two terminals in your diagram. Repeat this procedure until you have finished testing all the pairs. What does your final diagram look like?

动手做

首先，我们要做一个线路盒。线路盒是里面有电路的盒子。

取一个没有盖的粉笔盒。现在用一枚书钉，把它穿过盒壁。如图所示把书钉的脚扭弯，使书钉牢牢地固定在盒壁上。用同样的方法在盒子的不同壁上再钉上几枚书钉。用电线把几对书钉连接起来。用盖子盖住盒子。现在你看到的是一个封闭的盒子，钉在盒壁上的书钉的钉头露在外面。书钉的钉头叫做端纽。

把你的盒子转个方向。画一张表示端纽位置的图。用你的检验电路，看看回形针碰到一起时电路通不通。下一步是让回形针接触任何一对端纽。有电流通过两个端纽吗？如果有，就在图上画一条线连接这两个端纽。重复这一步骤，直到把各对端纽试完为止。你画完的图象什么？



Connections made
inside the octopus
box
线路盒内的导线连接

Before testing your circuit,
draw a diagram of this
kind.

在检验你的电路前
先画这样一张图



Open up the lid and see whether the
circuit you have drawn is like the actual
circuit in the box.

Ask your friend to make another octopus
box using a different number of paper
binders and a different set of connections.
Exchange your box with his. Test the
hidden circuit the same way as you have
tested the first. Draw the circuit diagram.
Check and see whether you are correct
by opening up the box.

打开盒盖，看看你画的电路是不是跟盒子里实际的
电路一样。

请你的朋友用不同数目的书钉和不同的组接方法再
做一个线路盒。把你的盒子和他的盒子交换一下。用检
验第一个电路同样的方法检验这个隐蔽的电路。画出电
路图。打开盒子检查一下，看看你画得是否正确。