

BASIC SCIENCE
自然科学

MAGNETISM

磁

吴永礼
董元骥
何崇义
邓静如

译
校

插图



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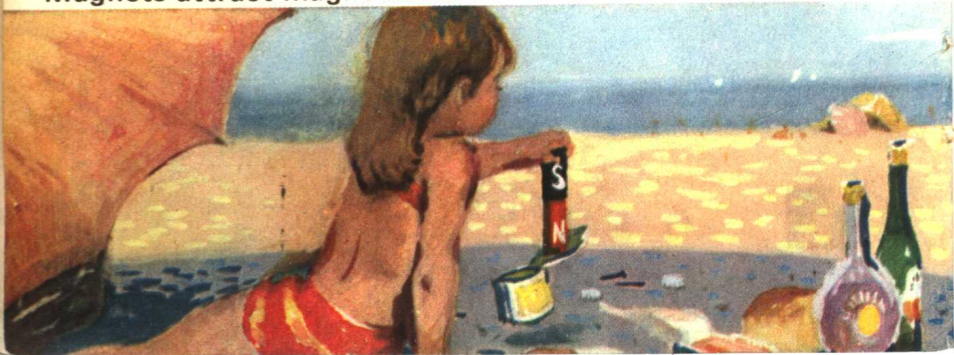
MAGNETS

Lodestone is a form of iron ore. It has two interesting properties:

1. Lodestone attracts small pieces of iron.
2. When lodestone is hung freely or floated on wood in water it points in a north-south direction.

Any substance which, like lodestone, has these two properties is called a **magnet**. Since lodestone can be mined from the earth it is called a **natural magnet**. Magnets can also be made by Man. Such magnets are called **artificial magnets**. Many magnets are made of iron and steel. Some magnets are made of mixtures of aluminium, nickel, cobalt and iron, and such magnets are very strong.

Magnets attract magnetic substances. 磁铁能吸引磁性物质



SHAPES OF MAGNETS

Magnets are of many shapes. Some are cylindrical rods and some are rectangular bars. They are called 'bar magnets'. Some are U-shaped. Some are called 'horse-shoe magnets' because they look like horse-shoes.

磁 铁

磁石是一种铁矿石，它有两个有趣的特性：

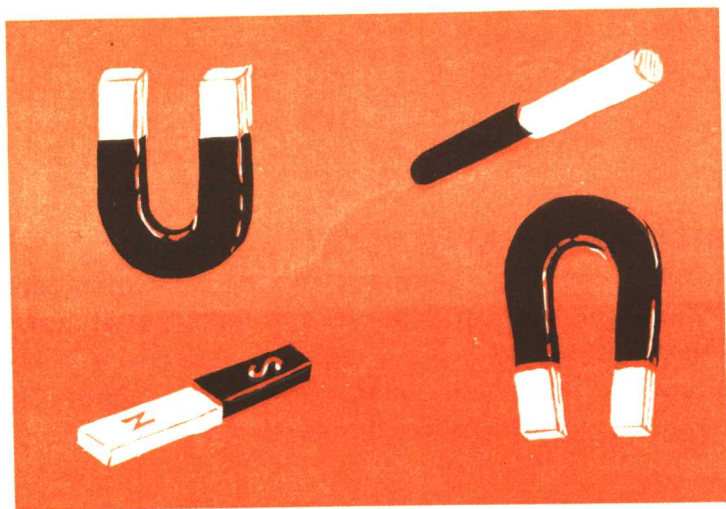
一、磁石吸引小铁块；

二、磁石悬空悬挂时，或者放在木头上浮在水中时，它指向南北方向。

象磁石那样具有这两个特性的任何物质叫**磁铁**。由于磁石能从地下采掘出来，因此称为**天然磁铁**。磁铁也能人工制造，这种磁铁称为**人造磁铁**。许多磁铁是由铁和钢制成的。有些磁铁是由铝、镍、钴和铁的合金制成的，这种磁铁磁力很强。

磁 铁 的 形 状

磁铁有许多形状。有的是圆棒，有的是长方条状，它们都叫“**条形磁铁**”。有的是U形。有的称为“**蹄形磁铁**”，因为它们看起来象马蹄铁。



Magnets of different shapes 各种形状的磁铁

MATERIALS A MAGNET WILL ATTRACT

A substance which is attracted by a magnet is called a **magnetic** substance. A substance which is not attracted by a magnet is called a **non-magnetic** substance. A magnetic substance can be made into a magnet. A non-magnetic substance cannot be made into a magnet.

磁铁能吸引的物质

能被磁铁吸引的物质称为**磁性物质**，不能被磁铁吸引的物质称为**非磁性物质**。磁性物质能制成磁铁，非磁性物质不能制成磁铁。

Things to Do

Use a magnet to find out whether the following substances are magnetic or non-magnetic.

- | | |
|--------------------|---------------|
| (1) ruler | (2) pencil |
| (3) comb | (4) tin |
| (5) glass | (6) nail |
| (7) screw driver | (8) coin |
| (9) scissors | (10) matchbox |
| (11) chalk | (12) cork |
| (13) thumb tack | (14) eraser |
| (15) clothes peg | |

动 手 做

用磁铁检验下列物质是磁性物质还是非磁性物质：

- | | |
|--------|---------|
| 一、直尺； | 二、铅笔； |
| 三、梳子； | 四、罐头盒； |
| 五、玻璃； | 六、钉子； |
| 七、旋凿； | 八、硬币； |
| 九、剪刀； | 十、火柴盒； |
| 十一、粉笔； | 十二、软木塞； |
| 十三、图钉； | 十四、橡皮； |
| 十五、衣夹。 | |

Testing substances with a magnet

用磁铁检验物质



THE STRONGEST PARTS OF A MAGNET

A magnet has an attractive force on magnetic materials. Is the attractive force the same all over a magnet?

Things to Do

Place a bar magnet in a container with paper clips in it. Pick up the magnet. Do any clips cling to the magnet? Where do most of the clips cling?

The experiment shows that the ends of the magnet have greater **magnetic force** than the middle portion of the magnet. Repeat the experiment with U-shaped, horse-shoe and cylindrical magnets. Do the ends of the magnets have greater magnetic force than the other parts?

The ends of a magnet are called the **magnetic poles** of the magnet. There is a magnetic pole at each end of a magnet. There always are magnetic poles on a magnet, no matter what its shape may be.

磁铁磁性最强的部分

磁铁对磁性物质有吸引力。磁铁每一部分的吸引力都相同吗？

动手做

把条形磁铁放入盛有回形针的容器。将磁铁拿起，是否有回形针紧紧吸附在磁铁上？大多数回形针紧紧吸附在磁铁的哪个部位？

这个实验表明，磁铁两端比磁铁中间部分具有更大的磁力。用U形、蹄形和圆棒形磁铁再做这一实验。磁铁两端比别的部位具有更大的磁力吗？

磁铁的两端称为磁铁的磁极。磁铁的两端各有一磁极。凡是磁铁都有磁极，而不论其形状如何。

Poles of a bar magnet 条形磁铁的磁极



THE STRENGTH OF A MAGNET

Let us find out about the strength of a magnet.
Do all magnets have the same strength?

Things to Do

Tie one end of a string to a paper clip. Attach the other end of the string to a wooden board with a drawing pin. Hold the magnet in one hand and pick up the paper clip until the string is taut. Keep on raising the magnet until it is separated from the clip as shown in the picture.

Keep on raising the magnet until the paper clip just begins to fall to the wooden board. Measure the distance between the lowest point in the magnet and the highest point of the clip. Repeat this with other magnets. Which was the strongest magnet?

MAGNETIC FORCE

A magnet has an attractive force. This magnetic force is able to pass through certain substances.

What are the substances that the magnetic force can pass through?



To test the strength of a magnet 试验磁铁的强度

磁铁的磁极强度

让我们判定磁铁的磁极强度。所有磁铁的磁极强度都一样吗？

动手做

把线的一端系在回形针上，线的另一端用图钉固定在木板上。一手拿着磁铁，将回形针吸起，直到线绷紧为止。继续往上提举磁铁，直到如图所示磁铁与回形针脱离为止。

继续往上提磁铁，直到回形针正好开始落向木板时为止。测量磁铁的最低点与回形针最高点之间的距离。用其他磁铁再做这一实验。哪个磁铁磁极最强？

磁力

磁铁有吸引力。这种磁力能透过某些物质。磁力能透过哪些物质呢？

Things to Do

- (i) Use a rubber band to hold an iron nail to a piece of wood which will float on water. Take a plastic basin and fill it with water. Now float the wood with the attached nail, in the basin. Hold a magnet under the basin and move it about slowly.

You will find that the wood will move in the same direction as the magnet. This is because the magnetic force is able to pass through the plastic basin and water, to attract the iron nail.

Hold the magnet further away from the bottom of the basin. Does the piece of floating wood move as readily as it did before?

- (ii) Take an iron nail, or a toy car made of iron, and place it on a wooden board. Hold a magnet about two centimetres below the wooden board and move it about slowly.

You will find that the nail, or the toy car, will move in the same direction as the magnet. This is because the magnetic force is able to pass through the piece of wood.

Now use different sheets of materials like glass, rubber and iron to see if the magnetic force is able to pass through them.

动手做

一、用橡皮筋把一个铁钉绑在一块会在水面飘浮的木板上。取一个塑料盆，盛上水。现在把带有铁钉的木板浮在塑料盆里。拿一块磁铁在塑料盆底下慢慢来回移动。

你会发现木板移动的方向与磁铁移动的方向相一致。这是因为磁力能够透过塑料盆和水吸引铁钉。

让磁铁离盆底远一些，飘浮的木板还象先前一样容易移动吗？

二、取一个铁钉，或是一辆铁制的玩具汽车，把它放在一块木板上。拿一块磁铁放在木板下方相距2厘米处，慢慢来回移动磁铁。

你会发现，钉子或玩具汽车会与磁铁向同一方向移动。这是因为磁力能透过这块木板。

现在用不同的板材，如玻璃板、橡皮板和铁板，看看磁力能否透过它们。



Magnetic force passes through wood.

磁力能透过木材

HOW TO MAKE MAGNETS

We can make our own magnets. Let us find out how we can do this.

怎样制造磁铁

我们可以造出我们自己的磁铁。让我们来看看怎样才能制成磁铁。

Things to Do

- (i) Take a magnet, a large iron nail and some paper clips. Touch the paper clips with the iron nail. Does the iron nail attract the paper clips?

Now place the magnet, the nail and the paper clips in a line. Move the clips closer to the nail. What happens to the clips? Take the magnet away. Does the nail still attract the clips? Does the nail still attract the paper clips a little while later?

- (ii) Take a magnet, a steel knitting needle and some paper clips. Put the knitting needle on a table and then stroke it with a magnet. Stroke the knitting needle in one direction, from one end of the needle to the other, using the same pole of the magnet all the time. Do this about 30 times. Pick up some paper clips with it. Your knitting



Making a magnet by stroking

用摩擦的方法制造磁铁

needle has now become a magnet. Does the knitting needle still attract the paper clips a little while later?

动 手 做

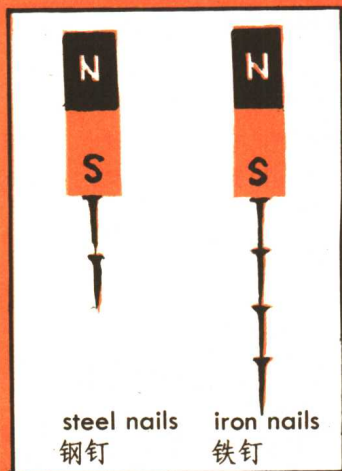
一、取一块磁铁、一个大铁钉和一些回形针。用铁钉去碰碰回形针，铁钉吸引回形针吗？

现在把磁铁、钉子和回形针排成一行，把回形针移近钉子，回形针会发生什么现象？拿走磁铁，钉子仍吸引回形针吗？稍过片刻，钉子还吸引回形针吗？

二、取一块磁铁、一根钢质毛衣针和一些回形针。把毛衣针放在桌上，然后用磁铁摩擦毛衣针。始终使用同一磁极，从毛衣针的一端向另一端沿同一方向摩擦毛衣针。这样摩擦大约30次。用毛衣针吸起回形针，现在你的毛衣针变成一块磁铁了。稍待片刻，毛衣针仍吸引回形针吗？

TYPES OF MAGNETS

There are two kinds of magnets: **temporary magnets** and **permanent magnets**. Temporary magnets are usually made of iron and are able to keep their magnetism for a short time only. Permanent magnets are usually made of steel and are able to keep their magnetism for a long time.

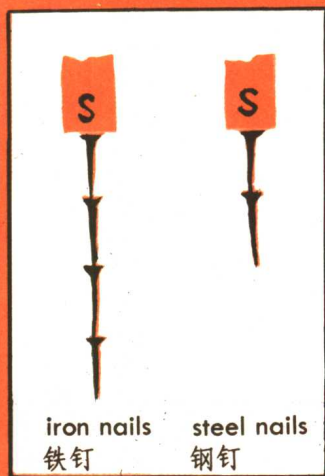


Iron loses its magnetism more quickly than steel.

铁比钢失掉磁性快

Iron is more easily magnetised than steel.

铁比钢易于磁化



磁 铁 的 类 型

有两种磁铁：暂时磁铁和永磁铁。暂时磁铁通常用铁制成，只能在短时间内保持磁性。永磁铁通常用钢制成，能长期保持磁性。

MAGNETIC COMPASSES

In a magnetic compass the magnetic needle is supported in such a way that it can rotate freely. When the compass is placed at rest, the needle will come to rest in a north-south direction. The two ends of the needle are marked differently so that we can know which is the North Pole of the needle and which is the South Pole.

Magnetic compasses are used by travellers and navigators to tell them the direction in which they are travelling. Two compasses which are commonly used are the Ship's Compass and the Pocket Compass.

磁 罗 盘

在磁罗盘中，磁针安装得能自由转动。罗盘处于静止状态时，指针总是指向南北方向。指针两端的标记是不同的，以便我们能认出哪个是指针的北极，哪个是南极。

旅行家和航海家使用磁罗盘辨别行进的方向。通常使用的两种罗盘是船用罗盘和袖珍罗盘。



Things to Do

- (i) Take a steel razor blade and magnetize it by stroking it with a magnet. Now you have a 'razor blade magnet'. Mark the North Pole of the razor blade and fix it to a piece of cork. Float the cork in water. See that there are no magnets or magnetic substances around. When the cork stops moving, the razor blade will point in a north-south direction.
- (ii) Magnetize a razor blade with a magnet as you did earlier. Mark the North Pole on it. Push a press stud into the centre of the razor blade and fix it tightly with some paper. Glue the razor blade onto a round piece of cardboard and mark the North Pole on the card. Now suspend the cardboard with the razor blade on a

pin stuck through a piece of cork so that it is able to move freely. You have made a simple compass. Keep your compass in a cardboard box so that it will not be blown about by the wind. Use the compass to find the direction in which your class is facing.

动手做

一、取一片钢质刮脸刀片，用磁铁摩擦它，使刀片磁化，即可得一“刮脸刀片磁铁”。标出刮脸刀片的北极，并把它固定在软木塞上。把软木塞浮于水中。注意周围不能有磁铁或磁性物质。当软木塞停止移动时，刮脸刀片就会指向南北方向。

二、象刚才你做的那样，用磁铁去磁化刮脸刀片。在刀片上标出北极。把一副揪纽按入这刮脸刀片的中心孔，并用一些纸把揪纽紧紧地固定住。把刮脸刀片粘在圆形硬纸板上，在纸板上标出北极。现在把这块带有刮脸刀片的厚纸板悬扣在插于软木塞的大头针上，以使它能自由转动。你已经制成了一个简单的罗盘。把你的罗盘放在纸盒内，使它不致被风吹动。用这个罗盘测出你们教室面对的方向。

A 'razor blade magnet' ‘刮脸刀片磁铁’

