

简易英汉对照科技丛书



力·量度

FORCES AND
MEASUREMENTS



原子能

ATOMS



太空与人

SPACE AND MAN

四川人民出版社



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INTRODUCTION

In our everyday life we see many moving things. We see cars, bicycles, buses, lorries and vans moving along the roads. We see aeroplanes flying in the sky and ships sailing in the sea. These are only a few examples of moving things.

Do you know what causes things to move? The answer is force. A force can be a push or a pull. If you exert a force on a cart it will start to move. If you increase the force, the cart will move faster and faster. This is called acceleration. If you stop pushing or pulling the cart, it will keep moving for some time before it stops. It is the same when we ride a bicycle. The bicycle will stop moving after some time if we do not keep on pedalling.

If you want to stop a moving cart, you must exert a force on it. In the same way if you want to stop your moving bicycle you apply the brake.

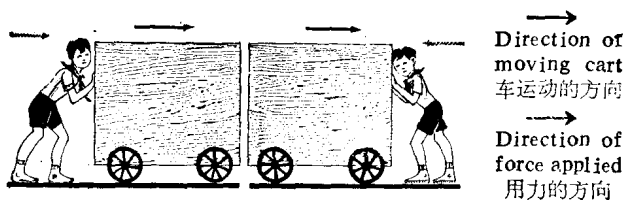
If an object is not moving it does not mean that there are no forces acting on it. An object will not move if there are equal and opposite forces acting on it.

引言

在日常生活中，我们看到许多运动着的東西。我们看到小汽车、自行车、公共汽车、卡车和带篷货车行驶在公路上。我们看到飞机飞翔在天空，轮船航行在海上。这些只是有关运动物体的几个例子。

你知道是什么东西使物体运动吗？是力。力可以是推力，也可以是拉力。如果你作用一个力在一辆车上，这辆车就会开始运动。如果你增大作用力，这辆车的运动就会越来越快。这就叫做加速。如果你停止推车或拉车，车还要行驶一段距离才会停下来。同样，当我们骑自行车时，如果我们停止蹬车，自行车也要行驶一段距离才会停下来。

要是你想使一辆行驶着的车停止下来，你必须对它作用一个力。同样，要是你想使行驶着的自行车停止下来，你就必须使用刹车。



如果一个物体没有运动，这并不意味着这个物体没有受力。要是大小相等、方向相反的两个力同时作用在一个物体上，这个物体就不会运动。

WHAT IS WEIGHT?

If you hold a book and then let it go, the book will fall to the ground. The book falls because a force pulls it down. This force is due to the Earth's gravity. The Earth's gravitational pull on an object is called its **weight**. A smaller gravitational force acts on a lighter object and a bigger force acts on a heavier object.

WEIGHING MACHINES

Weighing machines are used to find out the **weights** of objects or to compare the weights of different objects. There are many kinds of weighing machines. Next time you go shopping or marketing, find out the different ways in which shop-keepers weigh things.

Now let's find out more about the weighing of things and weighing machines. First, let us find out about a **see-saw**, which can be used as a simple weighing machine. Then we will find out how to make simple weighing machines and how to use them.

A SEE-SAW

Two boys, both of the same weight, sit on opposite sides of a see-saw. How far must they be from the centre in order to keep the see-saw

什么是重量？

如果你拿起一本书，然后把手放开，书就会落在地上。这本书所以会落下去，是因为有一个力把它拉了下去。这个力归因于地球的引力。地球的引力作用于物体上的拉力就叫做重量。较小的引力作用于较轻的物体上，而较大的引力则作用于较重的物体上。

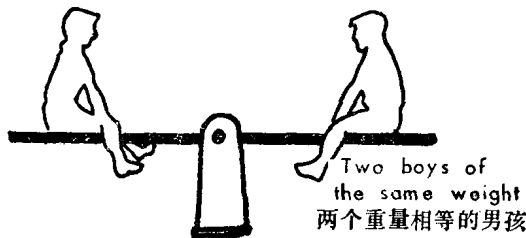
衡 器

衡器是用来称物体的重量或比较不同物体的重量的器具。衡器的种类很多。当你下次到商店或市场买东西的时候，弄清楚店主人是用哪些不同的方法来称东西的。

现在，让我们来对称量和衡器作进一步的了解。首先，让我们来考查一下跷跷板，因为我们可以把它用作一个简单的衡器。在考查之后，我们就会知道怎样去制作简单的衡器并使用它们。

1. 跷跷板

两个体重相等的男孩各坐在跷跷板的一头。要使跷跷板平衡，他们各应该离跷跷板的中心多远？



balanced!

By moving to different positions, they will soon find out that they have to sit at equal distances from the centre. Now, if one of them is heavier, the heavier boy has to be nearer to the centre to make the see-saw balance.

Things to Do

Take a stone in each hand. Can you find out which stone is heavier? If the two stones are about the same size, you may not be able to tell which one is heavier. But you can use a see-saw to find out which one is heavier.

Place a pencil on two piles of books and balance a ruler on it. Now place one stone on each side of the ruler and move them until the ruler is balanced. Find out how far each stone is from the pencil. The stone nearer to the pencil is the heavier one. Now you know how a simple weighing machine works.

SIMPLE WEIGHING MACHINES

There are very simple weighing machines which we can make. One is a **clamp balance** and the other is a **balloon strip balance**. These weighing machines are not very accurate. They

通过不断移动位置，他们很快就会发现，他们必须坐到离中心相等的地方才能使跷跷板平衡。现在，如果一个男孩重一些，那么要使跷跷板平衡，这个男孩就必须坐到离跷跷板的中心更近的地方才行。

做实验

两只手中各拿一块石头，你知道哪一块石头重一些吗？如果两块石头的大小都一样，你不可能说出哪一块石头更重。但是你能用一个跷跷板，看出哪一块石头重一些。

在两叠书上放一支铅笔，铅笔上放一把尺子，使尺子处于平衡位置。在尺子的两端各放一块石头，移动石头的位置，直到尺子平衡为止。看每一块石头离铅笔有多么远。离铅笔近的就是较重的那一块。现在你已知道简单衡器是怎样称东西的了。

2. 简单的衡器

有一些非常简单的衡器是我们能够制做的。其中，一种叫夹子天平，一种叫橡皮筋秤。这些简单的衡器都不是十分准确的，它们不能告诉我们一个物体的准确重量。工厂和商店使用复杂的衡器。这

do not give us the exact weight of an object. Complicated weighing machines are used in shops and factories. Mostly they are very accurate. Some are used for weighing meat, fish, peanuts, vegetables and other things, while some are used for weighing people.

Things to Do

- (i) Let's make a simple weighing machine called a clamp balance. For your clamp balance, you will need a clamp, a wooden rod about 1 metre long, a round pencil, two similar tin lids, each with three small holes, and a piece of thin string.

First of all, put one end of the pencil under some heavy books so that the other end juts out over the edge of a desk. Next, put the two wire holes of the clamp on to the pencil so that the clamp swings freely. By opening and shutting the clamp, place the wooden rod in a position where it balances. Make pencil marks at each end of the rod at equal distances from the clamp. Using a razor blade, make a little groove at each pencil mark. The grooves are for keeping the strings in place.

Now, to make the scale pans, tie the

些衡器大都非常准确。有的衡器用来称肉、鱼、花生、蔬菜和其它物品，有的则用来量我们的体重。

做实验

- (1) 现在，让我们来制作一种简单的衡器，夹子天平。要制作这样一个天平，你需要准备一个夹子、一根一米长的木棒、一支圆杆铅笔、两个大小差不多的白铁盒盖子，每个盖子上要钻三个小孔。另外还需要准备一根细绳子。

首先，把铅笔的一头压在几本很重的书下面，使铅笔的另一头伸出桌边。然后，通过夹子上的两个铁丝小孔把夹子套在铅笔上，使夹子能够自由摆动。不断打开并关闭夹子，以便把木棒夹在那个使它能够保持平衡的地方。以夹子为中心，用铅笔在木棒两端作若干等距离的记号。然后用刀片在每个作了记号的地方刻一条小槽。这些小槽可以卡住系天平盘的细绳，使其不致滑向左右。

现在开始做天平盘。把细绳拴在白铁盒

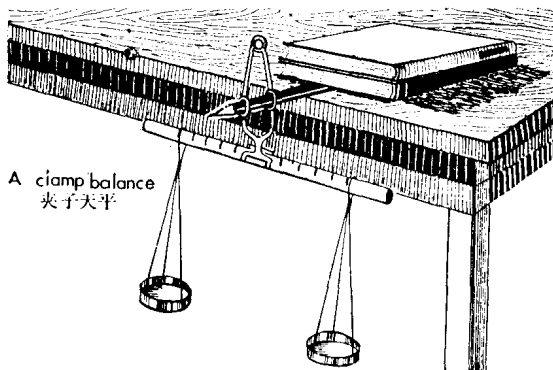
thin string to the three holes in the tin lids. Next, hang the scale pans from the grooves, first making sure that the rod is level. The pans must be placed at equal distances from the clamp. Do the pans balance? If they do not, stick some plasticine on the lighter pan. Now your clamp balance is ready for use.

Use your weighing machine to compare the weights of some objects such as peanuts, rubber, chalk and small stones. Place these objects on the scale pans and balance them with other objects. Find out which objects are heavier and which are lighter.

- (ii) To compare the weights of different objects properly, we must have standard weights. We can make our own standard weights by filling bottle-tops with plasticine. Now balance these bottle-tops against one another. Make sure they all weigh the same by taking away or adding plasticine to them. We will call these standard weights 'sprogs'.

Place a sprog on one scale pan and some identical buttons on the other. Find out how many buttons are balanced by one sprog.

盖的三个小孔上。然后把天平盘从刻好的小槽上吊下来。在吊天平盘之前一定要使木棒保持水平位置。两个天平盘必须吊在夹子两边等距离的地方。天平盘平衡吗？如果不平衡，就在轻的那只盘子上粘一点粘土。现在，你的夹子天平就只等使用了。



- 用你制作的衡器去比较花生、橡皮擦、粉笔和小石头等东西的重量。把这些东西放在天平盘上，然后用别的东西来使之平衡。看一看，哪些东西重一些，哪些东西轻一些。
- (2) 要想准确地比较不同物体的重量，就必须有标准重量。我们可以在小瓶盖中装上粘土来制成我们自己的标准重量。现在把装着粘土的小瓶盖一个一个地称一下。通过减少或增添粘土，务必保证它们都是一样的重。我们将把这些标准重量称为“斯普罗格”。

在一只天平盘内放上一个“斯普罗格”在另一只盘内放几个相同的钮扣。看一看，多少个钮扣才能平衡一个“斯普罗格”。

You can use your weighing machine to find the weight of a stone, a pen, a small ruler and so on. Place the object in one scale pan and put sprogs in the other until the balance is level. Record the weight of the object in sprogs. Now replace the sprogs with blocks. Record the weight of the object in blocks also.

- (iii) We can make another simple weighing machine called a rubber strip balance. Cut a rubber strip 1 cm wide and 10 cm long. Tie one end of the rubber strip to a stick and the other end to a scale pan as shown in the picture. Attach a paper clip pointer at the place where the scale pan is tied to the rubber strip.

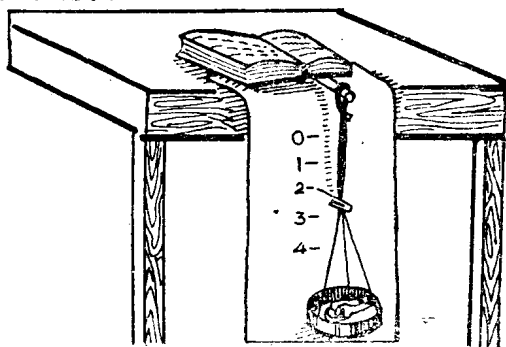
Hang your rubber strip balance over the side of a desk and put a heavy weight on the stick to hold it firmly. Now pin a piece of cardboard on the side of the desk so that a scale can be marked on it.

You can mark the scale in this way. Mark the position on the cardboard where the pointer lies when there is no sprog on the scale pan. Write 0 (zero) against this mark. Now place one sprog on the pan. You will find that the pan moves

现在，你可以用你的天平去称石头、钢笔、小尺子等东西了。在一只天平盘内放入一个物体，在另一只盘内放入一个又一个“斯普罗格”，直到天平平衡为止。以“斯普罗格”为单位，记下这个物体的重量。现在，用木块代替“斯普罗格”，以木块为单位，再记下这个物体的重量。

- (3) 我们还可以制造另一种简单的衡器，即橡皮筋秤。剪一条 10 厘米长 1 厘米宽的橡皮筋。如下图所示，橡皮筋的一端拴在一根木棒上，另一端吊上一个秤盘。在秤盘和橡皮筋连接的地方，固定一根用回形针做成的指针。如下图

所示，橡皮筋秤吊在桌子外边，用一个沉重的东西把木棒压住，使它固定不移。然后在桌边钉一张硬纸板，以便在纸板上可以标出刻度来。



你可以这样来标刻度。在秤盘中没有“斯普罗格”时，记下指针所指示的位置，在你记下的这个符号的旁边写一个“0”(零)。接着放一个“斯普罗格”在秤盘内。你会看

down a little. Mark the new position of the pointer on the cardboard. Write 1 for '1 sprog' against the new mark. Add more sprogs one by one and mark the position of the pointer each time. Write 2, 3, and so on against the marks. Now remove the sprogs one by one and check that the marks are still correct. Now you have made a rubber strip balance.

- (iv) We can use this machine for weighing things like stones, books, dusters and so on. We put the stone on the scale pan and read off the position of the pointer on the scale. If the pointer lies between the '3 sprogs' and '4 sprogs' mark, we say that the stone weighs more than 3 sprogs but less than 4 sprogs. Record the weights of all the other objects in this way.

WHAT IS WORK?

When you push against a big rock and if it does not move, then in the language of Science, you are not doing any work. Can you consider yourself working when you are studying or talking?

In Science, work is only done when a force moves something that has weight through a