

英语科普注释读物

A BOOK OF SCIENCE

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科学知识

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[英] 科林·罗南 著

潘绪年 钱石麒 注释

上海译文出版社

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上海译文出版社出版
上海延安中路 955 弄 14 号

新华书店上海发行所发行
上海市印刷四厂印刷

开本 787×1092 1/32 印张 4 25 字数 93,000
1985 年 6 月第 1 版 1985 年 6 月第 1 次印刷
印数: 00 001—26,500 册

书号: 9188·270 定价: 0.57 元

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22 WHAT "WEIGHT" MEANS*

When we want to *compare* a heavy thing *with*¹ a light

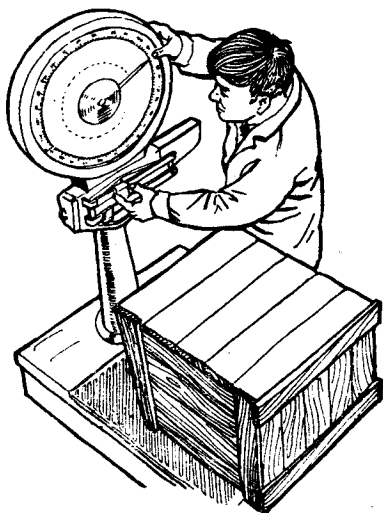


Fig. 1. A lever weighing machine for heavy weights

thing, we speak about its weight. This book does not weigh very much, and you can lift it easily with one hand; but you certainly could not pick up *a large slab of concrete*², even by using both your hands, because the concrete weighs much more than the book,

* '重量'意味着什么
of 一块,

1, 将...与...相比, 2, 一大块混凝土, a slab

To measure weight, we *make use of*³ various 'units' of measurement. Britain and America have used the '*avoirdupois*' system — ounces and pounds⁴. A baby may weigh 9 or 10 pounds *while*⁵ a 9-year-old boy may weigh as much as 50 or 60 pounds. *For*⁶ heavier things, such as coal, we use larger units. There are 120 pounds (*lbs*)⁷ in one hundredweight (*cwt*)⁸ and 2240 pounds or 20 hundredweight in one ton. (*By American measurements*⁹ there are 100 lbs in one cwt and 2000 lbs in one ton.) Many countries use the *metric system*¹⁰: 100 grammes equal about 3½ ounces, and 1 kilogramme (1000 grammes) equals about 2½ pounds. Britain will soon use this system.

*The weight of a body depends partly upon its size and partly upon the material of which it is made*¹¹. If you have a small piece of wood and also a large piece of the same kind of wood, then anyone knows that the large piece will be the heavier of the two. But if we weigh a piece of wood *against*¹² an equal-sized piece of lead, then we will find that the lead, *though no bigger*¹³, will have the greater weight, because lead is a much heavier material. A well-known trick is to ask someone, 'Which is the heavier, a pound of feathers or

-
3. 利用。 4. '常衡'制——盎司和磅。 5. 而，连词，表示对比。
 6. 这里的 For 作'至于，就…而言'解。 7. 拉丁语 *librae* (磅)的缩写。
 = pounds. 8. hundredweight (英担)的缩写。 9. 按美国度量。
 10. 公制，米制。 11. 物体的重量部分取决于物体的大小，部分取决于制成物体的物质。 *depend upon* = *depend on*: 取决于，*of which it is made*, 定语从句，修饰 *material*。 12. 这里的 *against* 作'与…对照'解， 13. 虽然体积不比木块大。这是省略的让步状语从句，

a pound of lead ?' Many people will answer quickly: 'Lead, of course; it is much heavier than feathers.' But they are wrong; both weigh one pound ! It is only the bulk which is different.

We can show this more exactly by using a *pair of scales*¹⁴. In one pan of the scales we put a piece of wood, and in the other pan a stone of exactly the same size (Fig. 2). The scales will *tip down*¹⁵ on the side of the stone. If we want to balance the scales, we must use a much bigger piece of wood. *Most weighing machines of this kind use measured or 'standard' 'weights' to put in one pan or at one end of the balancing machine*¹⁶, while the object to be weighed is put in the other.

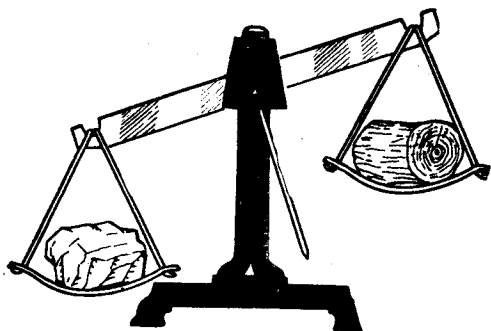


Fig. 2. Scales in which the weight in one pan is measured against the weight in the other

Another way of measuring weight is *to use what is called a spring balance*¹⁷. The object to be weighed is put into a

14. 一副天平。 15. 倾斜。
一个秤盘中或放在秤的一端。

16. 这种秤大多数使用‘标准’砝码，放在
17. 使用弹簧秤。

pan on top of a coiled spring¹⁸. As it presses down, the spring is compressed—more, or less, according to the weight of what is put into the pan¹⁹. The movement of the spring is made to work a pointer on a dial²⁰, and so the weight is recorded (see Chapter 26). Heavy things are often weighed by using a lever weighing machine²¹, as shown in Fig. 1.

Of course, a pair of scales or a spring balance works by means of²² gravity. The lead is being pulled down on our scales, and so is the piece of wood²³; but because the lead is heavier, it is being pulled down more strongly. If we could take our scales up on to the Moon, we would still find that the lead would weigh more than the same-sized piece of wood. But the Moon has less gravity than the Earth, and so neither the lead nor²⁴ the wood would weigh so much, for both would be pulled down much less strongly. But the lead would still be the heavier. If we put a pound of sugar on the scales on Earth, it would press down on the scales with a weight of 16 ozs²⁵; but on the Moon it would press down with a weight of only 2½ ozs. There is still exactly the same amount or 'mass' of sugar in the packet²⁶, but on the Moon only 2½ ozs of force has to be exerted to resist the pull of gravity instead of 16 ozs²⁷.

18. 弹簧。 19. 物体往下压时，弹簧被压缩，压缩多少则依放入秤盘中的物体的重量而定。 20. 推动刻度盘上的指针。 21. 磅秤。 22. 借助于。 23. 那块木头也如此。这是倒装句；这里的so是副词，作‘如此’解。 24. 既不…也不…。 25. ounces (盎司)的缩写。 26. 口袋里装的糖的量，即‘质量’，不变。这里的or作‘即’解。 27. 为了抵消引力，只要施加2½盎司力，而不是16盎司力，instead of；而不是。

*The Greek scientist Archimedes*²⁸, whom we read about in Chapter 18, discovered a very useful way of finding out the differences in weight (or mass) between two objects made of different materials, by measuring how much water each displaced. This is useful for weighing huge things such as ships, *which are awkward to put on scales*²⁹. The ship can be put into a dock full of water, and the amount of water which then overflows from the dock can be measured.

Another way of telling roughly the difference in weight (or mass) is to measure how much force is needed to move objects made of different materials. If you take a light ping-pong ball and tap it along a smooth table, a very light tap makes it start moving. But a much heavier tap would be needed to start *a brass ball of the same size*³⁰ moving on the same table. You can test the same thing by kicking a football along a field and then trying to kick a *cannon-ball*³¹ of the same size. Also less force is needed to stop a light ball than a heavy one, *as anyone knows who has tried to catch a light tennis ball or a heavy cricket ball, thrown hard*³². Scientists have ways of measuring this kind of force very exactly. But moving things, such as balls, are affected by other things as well as their weight and the force with which we kick or

28. 希腊科学家阿基米德.

29. 很难放在天平上. 非限制性定语从句, 修饰 ships, awkward 是形容词, 作‘难处理的’解.

30. 同样大小的黄铜球.

31. 炮弹.

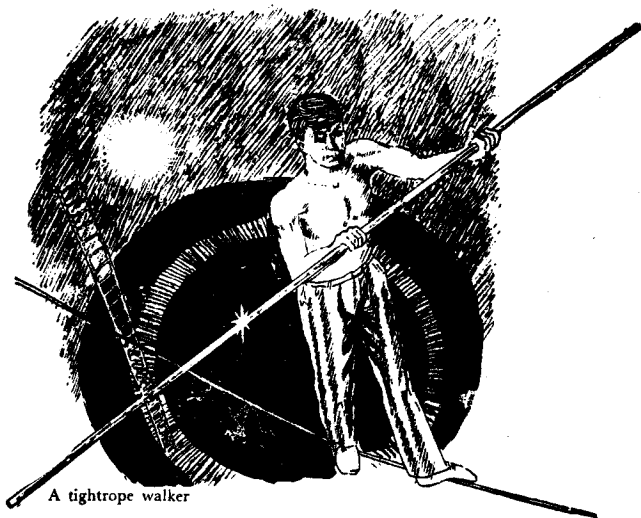
32. 正如任何试图抓住用力扔出的轻的网球和重的板球的人所了解的那样. who...cricket ball, 分隔定语从句, 修饰 anyone, thrown hard, 过去分词短语, 作后置定语, 修饰 a light tennis ball or a heavy cricket ball.

throw them. A ball kicked along a smooth road will travel much further than the same ball kicked with the same force along a rough field, because *the friction of the field*³³ resists the ball much more than the friction of the smooth road. Also, just as the air resistance holds back a feather more than a heavier penny³⁴, so does the friction of the rough surface hold back the light ball more than the heavy ball.

33. 场地的摩擦力,

34. 一枚较重的一便士钱币,

23 BALANCING*



If you have to carry a heavy load such as *a bucket full of water or a basket full of shopping*¹, you will usually have to use one hand only. You will find *it*² much easier to keep your balance and *stay upright*³ if you stretch out your other arm. *A tightrope-walker will usually stretch out both his arms*⁴, or perhaps carry a long pole with its ends stretching some

- * 平衡 1. 满满一桶水或满满一篮子购买的东西。 2. 这里的 it 是形式宾语，后面的 to keep ... and stay ... 是并列的不定式短语作实际宾语。
3. 使身体保持笔直。这里的 stay 是连系动词，upright 是形容词作表语。
4. 走钢索的人通常要伸出双臂。

way to either side of his body; this helps him to balance when he is walking along the narrow rope.

If you want to keep your balance when you are carrying a heavy load, or walking along a narrow place such as the top of a wall, you must move your 'centre of gravity'⁵ (in other words⁶, you must shift your weight) into such a position that you are less likely to *topple over*⁷. If you are carrying something *heavy*⁸ in your right hand, your centre of gravity will be moved over to the right side, so it is difficult not to topple over that way. But if you stretch out your left arm, you will move some of your weight across to the left side, and the centre of gravity will come back to a proper middle position. A tightrope-walker *spreads his weight about*⁹ by using his arms or a pole, so that his centre of gravity stays in the middle of his body, *even if*¹⁰ he does not keep perfectly upright as he moves along.

*This is true of things as well as people.*¹¹ *Supposing we want to make a pile of books, for convenience all the same size and thickness.*¹² We put one book on a table, and it lies quite safely. Its weight is *concentrated*¹³ at its centre of gravity, which lies in the middle of the book — *that is to say, the middle of the middle page*¹⁴. Then we put two more books

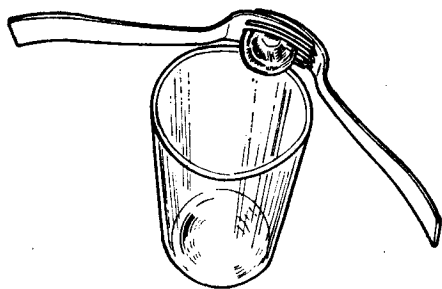
5. '重心', 6. 换言之. 7. 倒下. 8. 这里的 heavy 是后置定语, 修饰 something, anything 和 nothing 的定语往往后置. 9. 将他的重量扩散到全身, 这里的 about 是副词, 作'周围'解. 10. 即使. 11. 这种情况既适用于东西, 也适用于人, be true of: 适用于. 12. 假定我们要堆放一堆书, 为了方便起见, 假定这些书都同样大小, 同样厚薄, 13. 集中在..., 14. 就是说, 在中间一页的正中,

on top of the first one. Now the centre of gravity *will be shifted a little way upward*¹⁵; it will lie in the middle page of the middle book. As we go on¹⁶ piling books up, the centre of gravity will move further and further above the table, and the whole pile will become more and more unsteady. *By the time we have, say, twenty-one, and the centre of gravity has moved up to the middle of the eleventh book*¹⁷, the pile is so unsteady that *a slight tilt of the table*¹⁸ will bring them all down.

Try to balance a pencil across your finger.¹⁹ If more of the pencil is on one side of your finger, gravity will pull the pencil down that side, but if your finger is supporting the pencil exactly in the middle, the pull of gravity is the same on each side of your finger, and the pencil *stays balanced*²⁰; *it will not fall off even if you move your finger slowly about*²¹. Now try to stand the pencil on one end²², using a table — which is much steadier than your finger. It is not easy to make the pencil stand up, because the centre of gravity, which still lies in the middle of the pencil, is high above the table. The force of gravity makes the pencil *tumble down*²³ if it moves only very slightly to one side or the other.

15. 向上移动一点。 16. 继续下去。go on 后面跟动名词。 17. 譬如说，我们堆到了二十一本而重心移到了第十一本中间时。By the time: 到…时。say 这里作‘譬如说’解，插入语，作独立成份。 18. 使桌子稍微倾斜一点。 19. 试将一枝铅笔搁在你的手指上，使它平衡。 20. 保持平衡。这里的 balanced 是过去分词作表语。 21. 即使你将你的手指缓慢地朝四面八方移动，铅笔也不会跌落。fall off: 跌落。 22. 试将铅笔竖起来。 23. 跌倒。这是省略 to 的不定式短语，作宾语补足语。

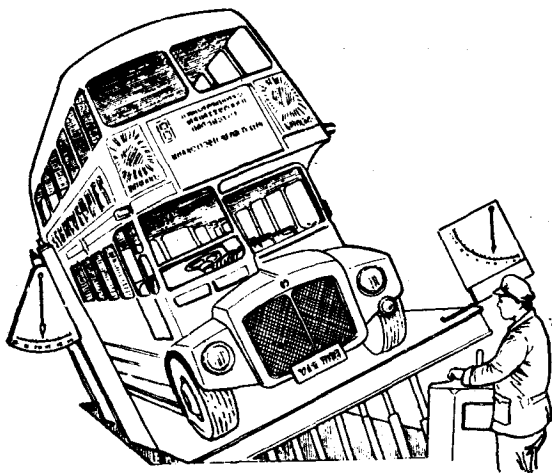
*It is fun to make a penny balance on the rim of a glass tumbler.*²⁴ You can do it quite easily if you place the penny with the rim exactly across its middle. If it is not across the middle it will fall down one side or other. But if you take two forks of the same size and fix the penny through their prongs, as shown in the picture, and tilt the handles of the forks slightly towards the glass, you can now make the penny balance on the glass rim with three-quarters or more of the penny on one side and a quarter or less on the other. You must adjust the forks and penny carefully until you have the balance correct²⁵. The penny remains balanced because the weight of the fork brings the centre of gravity below the point of balance of the penny, so that it pushes down on to the edge of the glass as well as balancing.



As we saw with our pile of books, *the lower the centre of*

24. 使一枚一便士钱币在玻璃酒杯边缘平衡是很有趣的。这里的 *it* 是形式主语, *to make ... a glass tumbler* 是不定式短语, 作实际主语。tumbler: 平底无脚酒杯。 25. 直到你取得适当平衡时为止。

gravity, the steadier the object will be²⁶. Toy shops often sell toy clowns with no legs and large round stomachs²⁷. However much you push them over, they always come back again to an upright position. This is because they are made with a heavy weight at the bottom of the stomach, so, *since*²⁸ almost all their weight is in the lower part, their centre of gravity is very low down. If you push the toy over, the centre of gravity is lifted up; but *as soon as you let go*²⁹, the centre of gravity falls down again, making the toy stand upright.



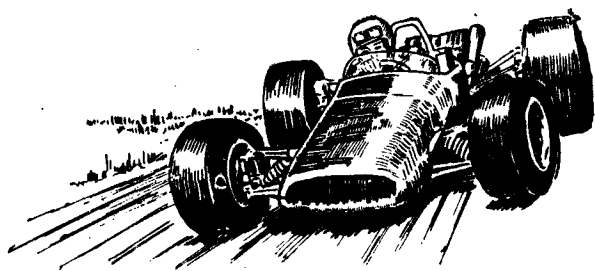
Testing a London bus to see how far it can tilt without falling over. Sand-bags are put on the top deck instead of passengers

26. 重心越低, 物体越平稳。
 这里的 *since* 作‘因为’解。

27. 无腿的, 大腹便便的不倒翁。
 29. 你一放手..., *as soon as*: 一...就..., *let go*: 放手。

You can do this yourself with a *lemonade bottle*³⁰. When the bottle is empty it is quite easy to *knock over*³¹; but if you put, say, 2 inches of water in the bottle, it will be much harder to knock over, because the weight of the water will have brought the centre of gravity down closer to the bottom. But if you *fill the bottle up*³², the centre of gravity is moved upward and therefore it is again easier to knock the bottle over.

Modern cars and trains are made with their centres of gravity low down, *so that they do not turn over when going round corners*³³. A large *double-decker bus*³⁴ is built so that its heavy parts are very close to the ground, and so it can carry a full load of passengers on its top deck *without any danger of toppling over on to its side*³⁵. *Even then*³⁶, the conductor will not let more people on the top than there are seats for, though he may, in *the rush hour*³⁷, let them stand



30. 汽水瓶。 31. 打翻。 32. 将瓶子装满。 33. 因此它们拐弯时不会翻倒。 34. 双层公共汽车。 35. 没有倾覆的危险。 36 尽管这样。 37. (公共车辆等的)高峰时间。