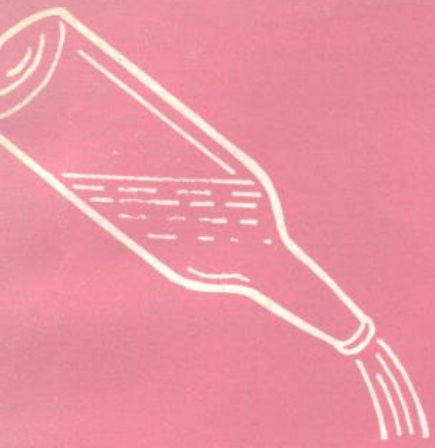
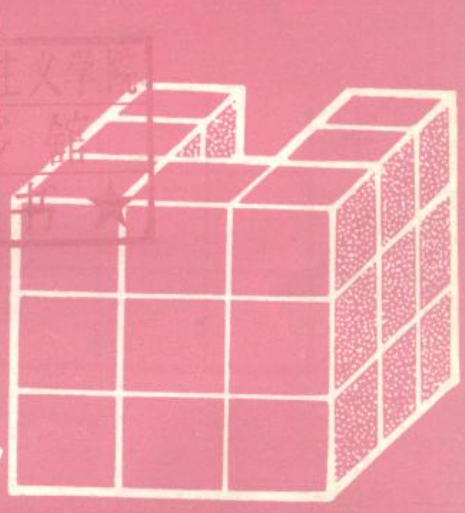


科普英语注释读物

GRAVITY

地心引力

〔美〕B.M.Parker 著



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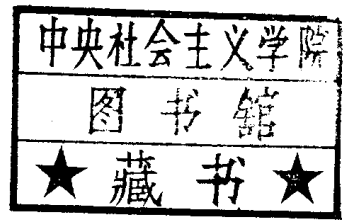

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CONTENTS

1. Gravity Pulls Things Down

Roger was playing in his back yard. He picked up a rubber ball and threw it just as hard as he could.① It went about twenty feet. Then it came back to his hands.

There was no string tied to the ball. There was no rubber band tied to it either. It did not hit a fence or a building or anything that made it bounce.② But it came back to Roger's hands. Can you think why?

Roger did not throw the ball straight out in front of him. He threw it straight up in the air. It went up for twenty feet and then fell down. Gravity made it come down.

The earth is pulling everything on it and near it. "Gravity" is the name we give to the pull of the earth on things on or near its surface.③

The children in the picture are coasting downhill.

Have you ever seen anyone start at the bottom and coast up a hill? Of course you never have. People can coast downhill because gravity pulls them down. Gravity always pulls things down, not up.

After the children get to the bottom of the hill, they will have to pull the sleds back up if they want to coast down again.④ To get the sleds to the top of the hill, they will have to pull up on the sleds harder than the earth is pulling down on them.

Of course you have played on a playground slide. Suppose someone should ask you why you always slide down the slide but never up the slide.⑤ Would you know? If you were at the bottom and gave yourself a push, you might slide up a little way. But very soon you would stop going up and would slide to the bottom again. Gravity pulls you down. When you are at the top of the slide, gravity pulls on you and makes you slide down. Gravity will not let you slide up.

Gravity helps you swing, too.⑥ Every time you push the swing up in the air, gravity pulls it back toward the ground.⑦

Have you ever watched a ski jumper? He slides down a long slope first. Gravity pulls him down the slope. When he reaches the take-off, he jumps up and sails through the air for a few seconds. But then he comes down again. Gravity makes him do so.

When you watch a person dive off a springboard into the water, you are seeing gravity at work again. The diver jumps up from the springboard. Why does he not keep on going up?⑧ Of course, it is gravity that pulls him down into the water.

The pole vault is one of the most interesting events at a track meet. The pole vaulter, with the help of his pole, leaps high into the air. At just the right moment he pushes his body over the crossbar and lets go of the pole. The pole falls backward, pulled by

gravity. The vaulter, also pulled by gravity, lands on the other side.

Perhaps you have been in front of a fire-engine house when there was a fire alarm. If you have, you may have seen some of the firemen sliding down poles from the upper floors of the building. Sliding down a pole is much faster than walking down stairs.⑨ But the firemen could not slide down the poles if there were no gravity.⑩

The picture below shows a juggler. A juggler really runs a race with gravity. He tries to catch each ball and throw it into the air again before gravity pulls it all the way down to the ground.

Maybe you have picked up apples that were lying under an apple tree. You knew that the apples had been hanging on the tree. After they were ripe, they fell to the ground. The first person to find out much about gravity was Sir Isaac Newton. An old story tells that he was lying under an apple tree one day and that an apple fell off the tree and hit him on the head. He began to wonder why apples should fall down instead of up. The apple started him to studying gravity. Probably this story of Newton is not true, but it is gravity that makes apples fall from apple trees to the ground.

In autumn the leaves of many of our trees fall off and make

piles that rustle as we walk through them. Gravity pulls them down.

You know that rain comes from clouds high in the sky. Probably you have never stopped to wonder how it gets down to us. Now you guess that gravity pulls the rain down, and your guess is right. Gravity makes snow and hail fall to the earth, too. Gravity is pulling every raindrop and snowflake and hailstone.

Have you ever seen a waterfall? There may be a deep cliff in the bed of a stream. When the water reaches the top of the cliff, gravity pulls it to the bottom of the cliff. Without gravity the water would not fall over the cliff.⑪ Can you imagine how funny it would be to see a stream flowing along through the air?

But it is really foolish to think of a stream flowing through the air. For if there were no gravity to make a stream fall over a cliff, the stream would not flow at all. It is gravity that makes brooks and streams and rivers flow. Many rivers begin in mountains or hills. Gravity pulls the water down toward the sea. Even when you see a river flowing through land that looks level, you can be sure that gravity is making it flow. The land really has a gentle slope, and gravity keeps the river flowing.

Water does not flow out of the oceans. There is no place for it to go. Gravity has pulled it down as far as it can.

You are seeing gravity work every time you pour water from a pitcher into a glass. If there were no gravity, no water would fall out of a pitcher even if you turned it upside down.

When you are out at night, you may see a shooting star. Something bright shoots across the sky toward the earth.⑫ You can see the trail of light it leaves. Shooting stars are pieces of rock that travel around the sun just as the earth does. When one of them gets near the earth, gravity pulls it to the earth. But you need

not be afraid that a shooting star will hit you. Shooting stars get so hot as they fall through the air that there is nothing left of them but ashes.⑬

Once in a while, however, a big stone falls out of the sky to the earth. Such a stone is called a "meteorite". In Arizona there is a great hole in the ground made by a meteorite which hit the earth. Of course, it was gravity that pulled it down.

Do you see now that gravity is always pulling down on everything that is on or near the earth? If you watch carefully you are sure to see many signs that gravity is at work.

New Words

gravity ['grævitiˌ] *n.* 地心引力，重力
Roger ['rɔdʒə] *n.* 罗杰(人名)
rubber ['rʌbə] *n.* 橡胶
throw [θrəu] (threw [θru:], thrown [θrəun]) *v.* 抛，投
string [striŋ] *n.* 绳，带，线
tie [tai] *v.* 扎，绑，系
fence [fens] *n.* 篱笆，栅栏
bounce [bauns] *v.* (球等)反跳，弹起
straight [streit] *ad.* 径直地
pull [pul] *n.* 吸引(力)，拉(力) *v.* 吸引，拉
surface ['sə:fis] *n.* 表面
coast [keust] *v.* (靠惯性)滑行(下坡)
downhill ['daunhil] *ad.* 往山脚下
bottom ['bɔtəm] *n.* 底，底部
sled [sled] *n.* (小)雪橇
suppose [sə'pəuz] *vt.* 假定，假设
slide [slaid] *v.* 滑动 *n.* 滑梯
swing [swiŋ] (swung [swʌŋ]) *v.* 摆动；荡秋千 *n.* 秋千
ski [ski:] *vi.* 滑雪
jumper ['dʒʌmpə] *n.* 跳跃者
slope [sləup] *n.* 斜坡
reach [ri:tʃ] *v.* 到达；达到
take-off *n.* 起跳点
sail [seil] *v.* 航行，飞行
dive [daiv] *vi.* 跳水，潜水
springboard ['spriŋbɔ:d] *n.* 跳板
pole [pəul] *n.* 杆，竿
vault [vɔ:lt] *n.*, *v.* 撑竿跳
event [i'vent] *n.* (运动会的)比

赛项目
track [træk] *n.* 径赛运动，田径运动
leap [li:p] (leapt [lept] 或 leaped [li:pt]) *v.* 跳，跃
crossbar ['krɔsbɑ:] *n.* 横杆
land [lænd] *n.* 陆地 *v.* 着陆，登陆
perhaps [pə'hæps] *ad.* 或许
fire-engine ['faiə-'endʒin] *n.* 救火车，消防车
alarm [ə'lɑ:m] *n.* 警报
upper ['ʌpə] *a.* 上面的
stairs [stɛəz] *n.* (用作单或复) 楼梯 *ad.* 在(向)楼上
juggler ['dʒʌglə] *n.* 玩杂要的人，魔术师
race [reis] *n.* 竞赛，赛跑
catch [kætʃ] (caught [kɔ:t]) *v.* 抓住，捉
hang [hæŋ] (hung [hʌŋ] 或 hanged) *v.* 悬，挂
ripe [raip] *a.* 成熟的
Isaac Newton ['aizək 'nju:tn] *n.* 艾萨克·牛顿(英国物理学家)
hit [hit] (hit, hitting) *v.* 打，击，撞
wonder ['wʌndə] *v.* 感到奇怪，感到怀疑
probably ['prɔbəbli] *ad.* 大概，或许
autumn ['ɔ:təm] *n.* 秋天
leaves [li:vz] *n.* (leaf 的复数) 叶子
pile [pail] *n.* 堆 *v.* 堆积，拥
rustle ['rʌsl] *v.* (树叶等)沙沙作响 *n.* 沙沙声
guess [ges] *v.* 猜测
raindrop ['reindrɔp] *n.* 雨点
snowflake ['snəufleik] *n.* 雪片，雪花
hailstone ['heilstəun] *n.* 冰雹块
waterfall ['wɔ:tə'fɔ:l] *n.* 瀑布
cliff [klif] *n.* 峭壁
stream [stri:m] *n.* (小)河，流
imagine [i'mædʒin] *v.* 想象，推测
funny ['fʌni] *a.* 有趣的
brook [bruk] *n.* 小河，溪
mountain ['mauntin] *n.* 山
hill [hil] *n.* 小山，丘陵
gentle ['dʒentl] *a.* 轻度的；和缓的
ocean ['əuʃən] *n.* 洋；大海
pitcher ['pitʃə] *n.* 大水瓶
shoot [ʃu:t] (shot [ʃɔt]) *v.* 射，飞速通过
shooting star 流星
trail [treil] *n.* 痕迹，足迹
travel [trævl] *v.* 旅行；行驶
afraid [ə'freid] *a.* 害怕的
ash [æʃ] *n.* 灰
meteorite ['mi:tjərait] *n.* 陨石
Arizona [ˌæri'zəunə] *n.* 亚利桑那(美国州名)
sign ['sain] *n.* 记号，信号，现象

Phrases and Expressions

pick up 拣起
in front of 在...前面
at work 在工作；(因素等)在起作用
with the help of 借助于，在...帮助下
let go of 松手放开
run a race 赛跑
all the way 从头至尾，一直
instead of 代替；而不是
at all 根本，全然
once in a while 偶尔，间或

Notes

① ... as hard as he could: as ... as 引出的是比较状语从句，这里表示程度上的比较，hard 为副词。在 as he could 后面省略了动词 throw 和它的宾语 it。该从句的意思是"他(抛出这个皮球)所用的力与他能够使出的力一样大"，也就是"他用了全身力气(把这个皮球抛了出去)"。

② ... or anything that made it bounce: bounce 是不带 to 的动词不定式，在句中作宾语补语，因受 made 支配，故不用 "to" 这个符号。类似这样的动词还有 let, have, see, watch, notice, feel, hear 等。

③ "Gravity" is the name we give to the pull of the earth on things on or near its surface. we give ... surface 为 name 的定语从句，省去了用作宾语的关系代词 which (或 that)。从句中前一个介词 on 与 pull 搭配使用；后一个介词 on 与 its surface 构成一个短语，作 things 的定语。

④ ... they will have to pull the sleds back up: 这里的 have to 是情态动词，意思与 must 差不多，但 have to 比较强调客观需要，有"不得不"的含义，且 have to 能用于多种时态中，本句就是一例。

⑤ ... why you always slide down the slide but never up the slide: 注意这个宾语从句中前一个 slide 为从句的谓语动词，意为"滑动"，后一个 slide 是名词，解释为"滑梯"，作介词 down 的宾语；

but 为并列连词，它所连接的第二个分句中省略了主语 you 和谓语动词 slide.

⑥ Gravity helps you swing, too. swing 也是省略了 to 的动词不定式，但动词 help 与注②中的 make 不同，其宾语补语如为动词不定式，符号 to 可省可不省。

⑦ Every time you push the swing up in the air, gravity pulls it back toward the ground. 这里的 every time 引出的是时间状语从句，类似的词还有 the first time, next time, the moment, the minute 等。例如：Bring the book to me next time you come here. 下次来时把那本书带给我。

⑧ ... keep on going up: keep on 后常接... ing 形式，即 keep on doing (sth.)，意思是"继续(进行)"或"继续(做)下去"。

⑨ Sliding down a pole is much faster than walking down stairs. sliding down a pole 是动名词短语作主句的主语，than 引出的是比较状语从句，该从句的主语是动名词短语 walking down stairs，但它的谓语 is fast 被省略。

⑩ But the firemen could not slide down the poles if there were no gravity. 这句用的是虚拟语气，表示一种与事实相反的假设。用虚拟语气表示的句子在本书中多次出现，请注意这类句子中谓语动词的形式。

⑪ Without gravity the water would not fall over the cliff. 这也是用虚拟语气表示的一个句子。用虚拟语气假设的情况，除了用 if 引导条件从句外，也可以用介词短语或其它形式来表示。

⑫ Something bright shoots across the sky toward the earth. 形容词 bright 是不定代词 something 的定语。在英语中，象 something, anything, everything, nothing 等代词用形容词作定语时，形容词要放在代词之后。例如，只能说 something heavy, 而不说 heavy something.

⑬ Shooting stars get so hot as they fall through the air that

there is nothing left of them but ashes. 句中 so ... that 引导结果状语从句；as 引导的是时间状语从句，用来修饰主句的谓语 get so hot；nothing ... but 意为“除了...以外什么也没有”，或“什么也没有，只有…”。

2. Weighing Things

Roger and his father were going on a trip. They were in the railroad station waiting for the train to come.① Roger was looking at things in the station. He saw a platform scale. It was the kind of scale that tells your weight when you stand on it and put a penny in the slot.②

"May I weigh myself?" Roger asked his father.

His father said, "Yes." He handed Roger a penny. Roger took the penny, but it slipped out of his hand. It fell to the floor.

Roger picked up the penny. He stepped on the scale. He put the penny in the slot and heard it fall down inside. Then he watched the arrow on the scale. The arrow turned until it pointed to the number 80.

"Look. Father," said Roger. "I weigh 80 pounds."

Roger got off the scale. He was still thinking about weighing himself. "Father," he asked, "What makes me weigh 80 pounds?"

Instead of answering, his father asked Roger another question. "Do you know what made your penny fall to the floor when you dropped it?"

"Yes," said Roger. "Gravity made it fall."

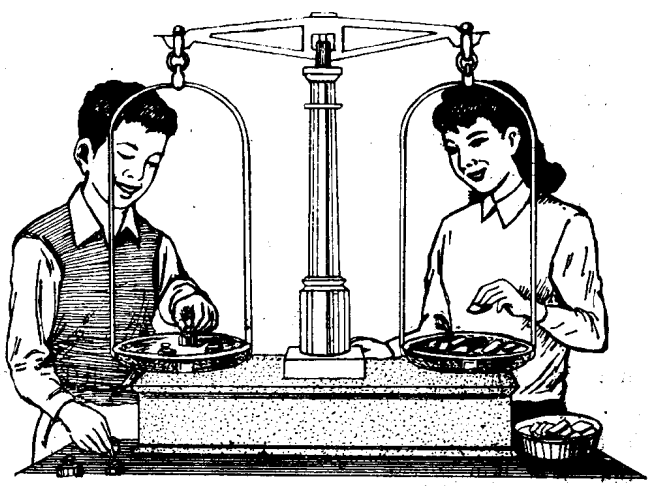
"The same thing that made your penny fall makes you weigh something,③" said his father. "Gravity pulls on you just as it pulled on the penny. It pulls you all the time. When you weigh yourself, you are finding out how much gravity is pulling on you. A scale measures the pull of gravity on anything that is put on it. You found out just now that gravity is pulling on you with a force of 80 pounds."

"You weigh more than I do,④ don't you, Father?" asked Roger.

"Yes." his father answered. "I weigh more than twice as much.⑤ I am made of the same kind of stuff that you are made of, but I am bigger than you are. There is more of me for gravity to pull."⑥

You can find out how much gravity is pulling on you by weighing yourself. You can measure the pull of gravity on other things by weighing them, too.

The picture below shows one of scales for weighing things. Suppose you want to weigh a book. You put it on one pan of the scale. That pan goes down. Then you put weights on other pan. You add or take off weights until the two pans balance. Weights have numbers on them that tell how much they weigh. Adding the numbers on the weights you used will tell you how much the book weighs. Gravity is pulling on the book just as it is pulling on the weights. If it were not, the two pans would not balance.



Which is heavier, a pound of lead or a pound of feather? Many people say, "Lead," because they know that lead is heavy and feathers are light. But if you put a pound of lead on one of a scale and a pound of feather on the other, the two will balance each other. Gravity is pulling just as hard on the pound of feathers as it is on the pound of lead. Of course, it takes only a little lead to weigh a pound.⑦ There are a great many feathers in a pound of feathers.

New Words

weigh [wei] *vt.*, *vi.* 称...重量；重...
trip [trip] *n.* 旅行
railroad ['reilrəud] *n.* 铁路
platform ['plætfɔ:m] *n.* 台，讲台
scale [skeil] *n.* 天平，磅秤
weight [weit] *n.* 重量；重物；砝码；体重
penny ['peni] *n.* 分(美国辅币)
slot [slɔt] *n.* 口，长孔
step [step] *v.* 走，踏
arrow ['ærəu] *n.* 箭头
point [pɔint] *v.* 指
pound [paund] *n.* 磅
measure ['meʒə] *v.* 量，测量
twice [twais] *ad.* 两次；两倍
stuff [stʌf] *n.* 材料
pan [pæn] *n.* 盘子
balance ['bæləns] *v.* 平衡
add [æd] *v.* 加，增加
lead [led] *n.* 铅
feather ['feðə] *n.* 羽毛

Phrases and Expressions

go on a trip 去旅行
look at 瞧，看
all the time 总是，每时每刻
find out 发现，找出，搞清楚
with a force of 用(以)...力
take off 拿下，去掉
a great many 大量，许多

Notes

① ... waiting for the train to come: 这是现在分词短语，用作状语，表示伴随情况。

② It was the kind of scale that tells your weight when you stand on it and put a penny in the slot. that ... slot 为定语从句，修饰 the kind of scale, 该从句中的 when 又引导一个时间状语从句，修饰谓语动词 tells。

③ The same thing that made your penny fall makes you weigh something: that ... fall 是定语从句，修饰 the same thing; weigh something 是主句谓语动词 makes 的宾语补语，这里的 something 是副词，作"几分"，"多少"讲，weigh something 意即"称得一点重量，或有点重量"。

④ You weigh more than I do: 这里的 do 是代替前面的动词 weigh, 以避免重复。又如: We have set up more power plants this year than we did last year. 今年我们兴建了比去年更多的发电厂。

⑤ I weigh more than twice as much: twice 是"两倍"的意思。这句可译为"我的体重是你的两倍之多"，或"我比你重一倍之多"。句末的 as much 是副词短语，强调程度或份量，意即"这样之多"。

⑥ There is more of me for gravity to pull. 这里的 more 是名词，作主语，意为"更多的数量"或"更多的东西"；介词短语 of me 和动词不定式短语 for gravity to pull 都为 more 的定语；gravity 是不定式 to pull 的行为主体，由介词 for 引出，一起构成不定式短语。

⑦ ... it takes only a little lead to weigh a pound: takes 在这里作"需要"或"用"解。又如: It takes two hours to get there. 到那里要用两小时。