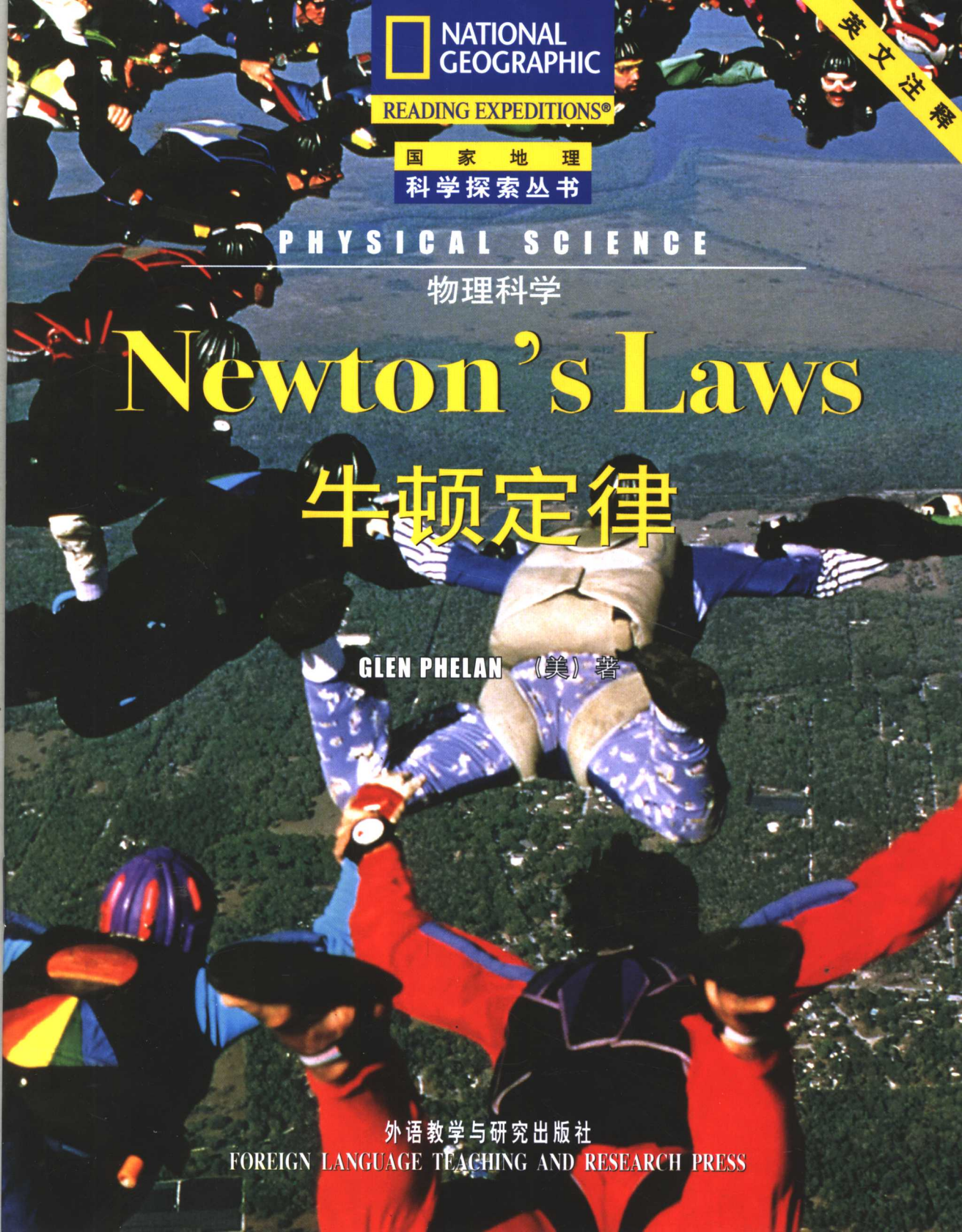
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英文注释
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物理科学
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牛顿定律
GLEN PHELAN （美）著
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如果你希望在享受英语阅读乐趣的同时又能增长知识、开拓视野，由外语教学与研究出版社与美国国家地理学会合作出版的“国家地理科学探索丛书”（英文注释版）正是你的选择。

“国家地理科学探索丛书”（英文注释版）第二辑分为8个系列，共46本，内容涉及自然科学和社会研究，除对本套丛书第一辑已包含的“生命科学”、“物理科学”、“地球科学”和“文明的进程”4个系列进行了补充外，又推出了4个新的系列——“生活中的科学”、“科学背后的数学”、“专题研究”以及“站在时代前沿的科学家”。

这套丛书秉承《国家地理》杂志图文并茂的特色，在书中配有大量精彩的图片，文字地道易懂、深入浅出，将科学性和趣味性完美结合，称得上是一套精致的小百科全书。特别值得一提的是本套丛书在提高青少年读者英语阅读能力的同时，还注重培养他们的科学探索精神、动手能力、逻辑思维能力和沟通能力。

本套丛书既适合学生自学，又可用于课堂教学。丛书各个系列均配有一本教师用书，内容包括背景知识介绍、技能训练提示、评估测试、多项选择题及答案等详尽的教学指导，是对课堂教学的极好补充。

英文注释

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Newton's Laws

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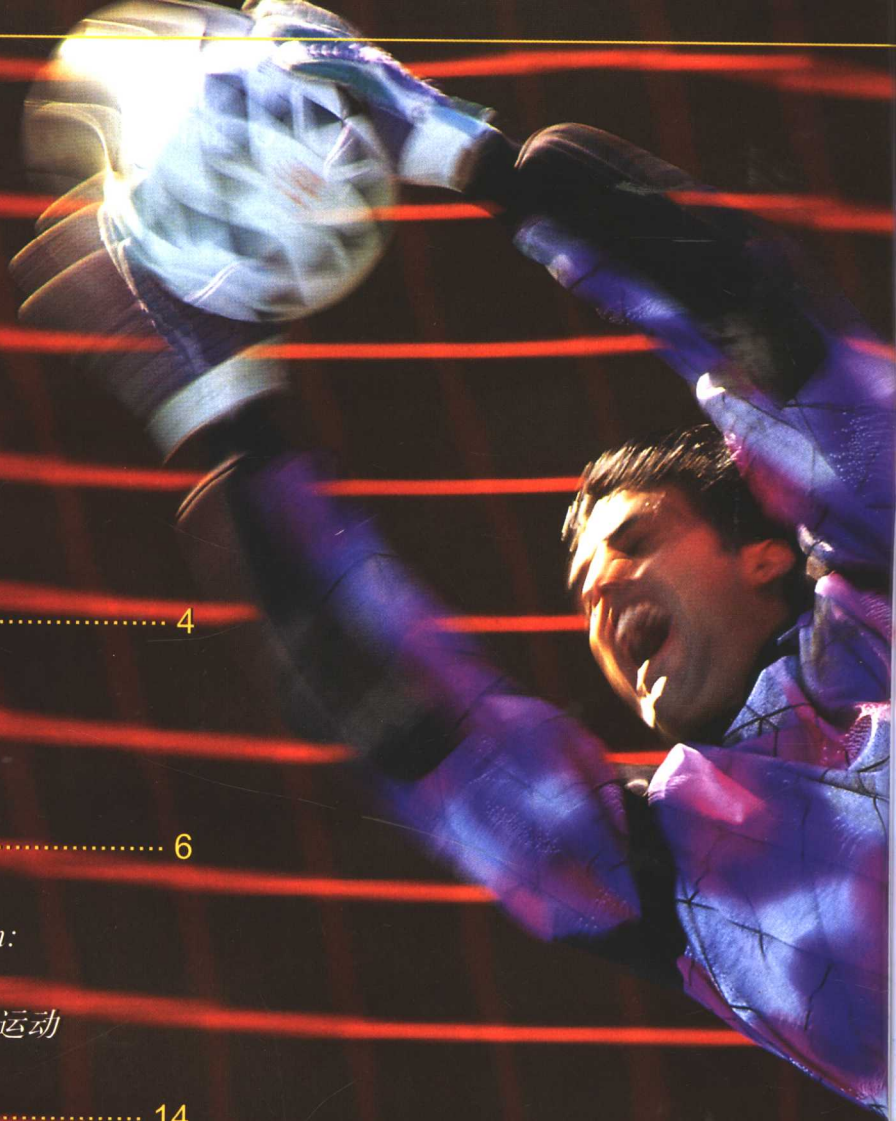
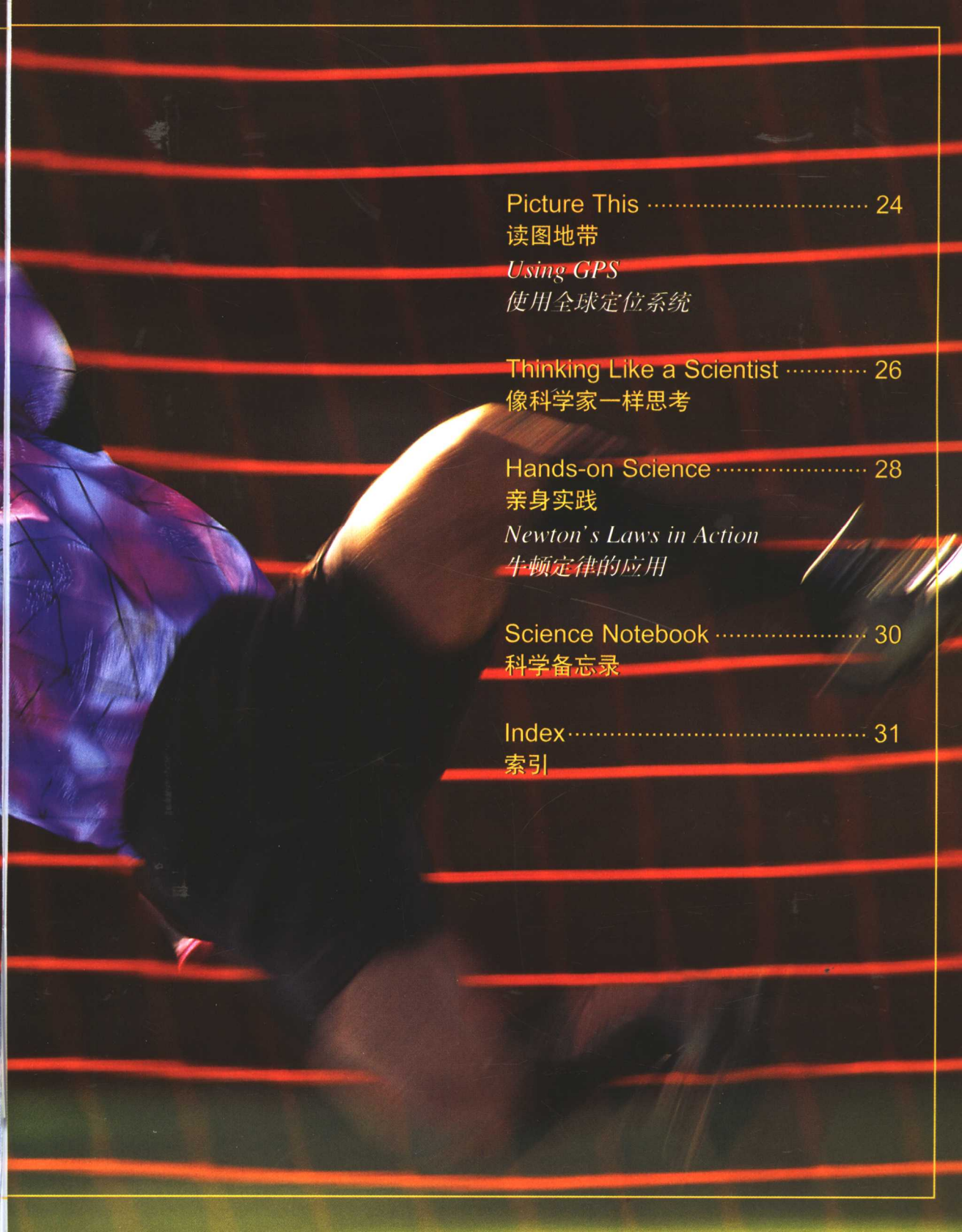
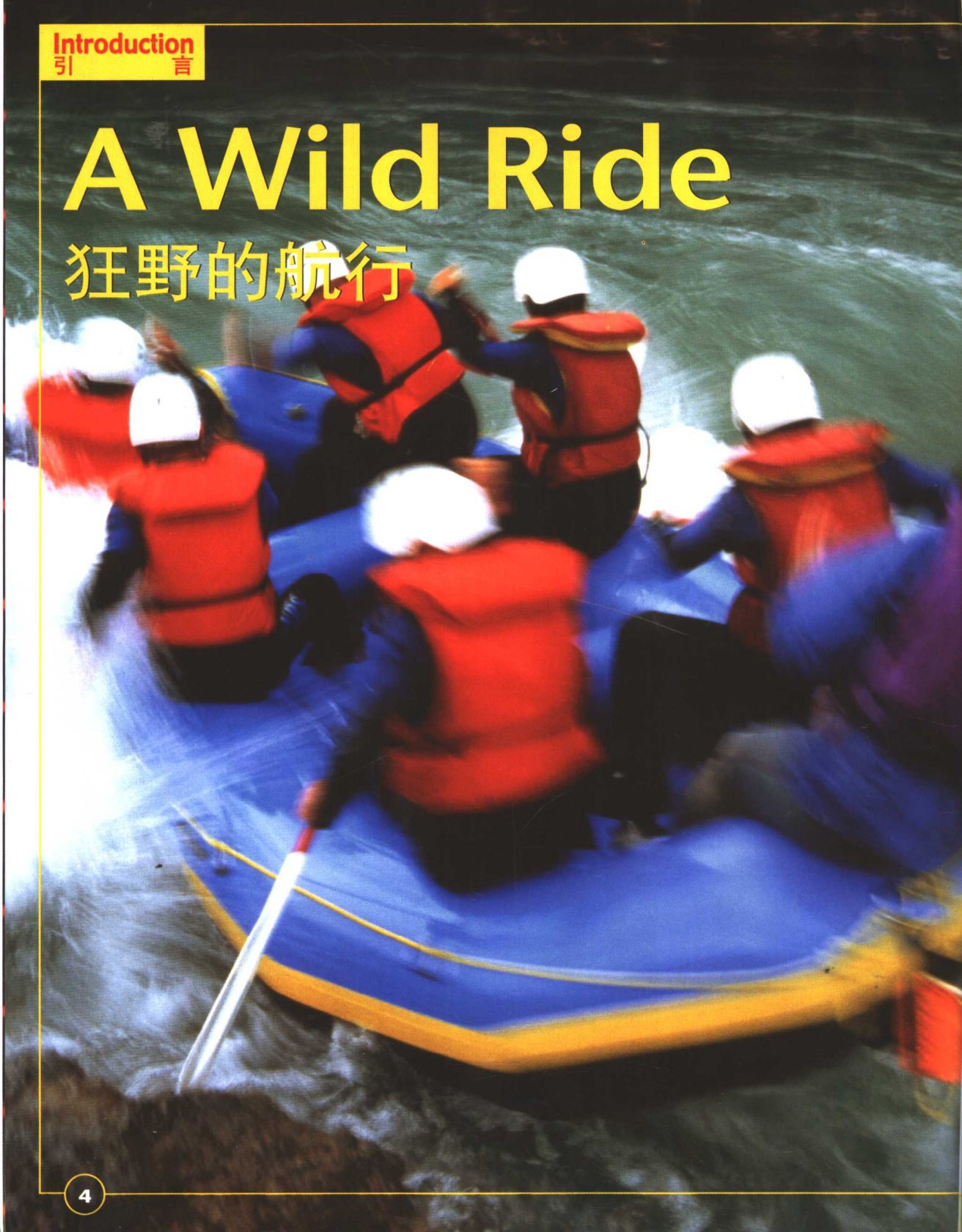




A Wild Ride

狂野的航行



Watch it. Rocks up ahead. Everyone on the right, paddle[1] hard! Left side, back paddle! Okay, big drop coming up. Here we go!

Wow, what an awesome[2] ride! It started calmly way upstream[3] as the rafters[4] pushed off the shore into the river's current[5]. Now and then they used their paddles to steer[6] around a sandbar[7], a boulder[8], or a downed tree. Then around a bend[9], the rafters saw what they came for—white water rapids[10].

For several minutes the swirling[11] water bounced[12] the raft back and forth like a pinball[13]. The guide[14] instructed the rafters on how to paddle to avoid rocks and keep the raft from tipping over[15]. Without the guide the rafters would have been in trouble. There was someone else helping out, too. His name is Isaac Newton[16]. No, he wasn't in the raft. But almost 300 years ago, he explained how all objects move. Since then, people have been using his laws of motion to better control how things move—including a raft in a raging[17] torrent[18].

What were Newton's ideas about motion? They're simple really. And simply amazing[19]!

1. paddle	*v.*	用桨划（船）
2. awesome	*adj.*	令人惊叹的
3. upstream	*adv.*	逆流地
4. rafter	*n.*	放筏运动员
5. current	*n.*	水流
6. steer	*v.*	操舵
7. sandbar	*n.*	河口沙洲
8. boulder	*n.*	巨砾，漂砾
9. bend	*n.*	（河流等的）弯曲处
10. rapid	*n.*	急流
11. swirling	*n.*	旋动的
12. bounce	*v.*	使反弹，使颠跳
13. pinball	*n.*	弹球戏
14. guide	*n.*	向导
15. tip over		翻倒，倾倒
16. Isaac Newton		艾萨克·牛顿（英国物理学家、数学家和天文学家）
17. raging	*adj.*	凶猛的
18. torrent	*n.*	急流
19. amazing	*adj.*	惊人的

Chapter 第一章 1

Newton's Laws of Motion:

Moving by the Rules

牛顿运动定律：有规律的运动

These kids will quickly reach the bottom of this giant[1] slide[2]. Once they are on flat ground, they'll continue to move forward before slowing down and stopping. Why don't they stop immediately at the bottom of the slide?

1. giant *adj.* 特大的
2. slide *n.* 滑梯，滑道

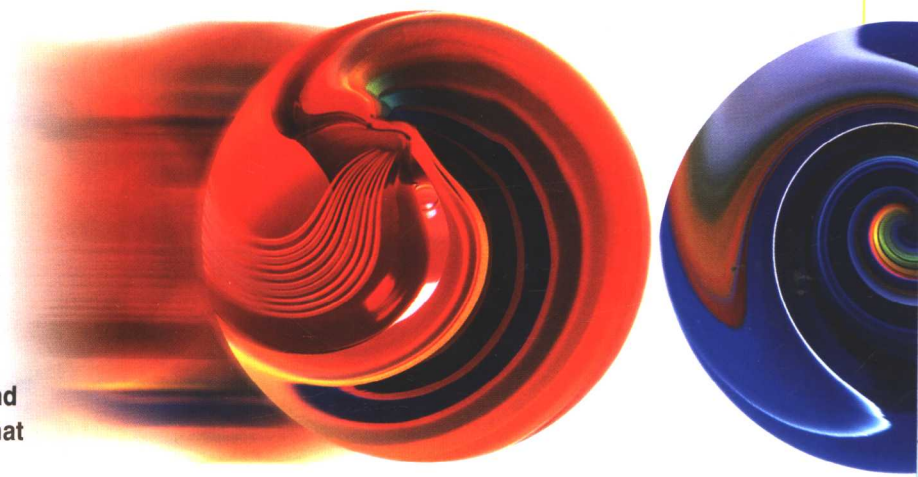
The kids continue moving because they have inertia[1]. Inertia is the tendency[2] of an object to resist[3] any change in motion.

Inertia and Force[4]

You see inertia's effects[5] all the time. Once an object is moving, it tends to[6] keep moving. Something has to make it speed up, slow down, or change direction. Also, when an object is at rest (not moving), it tends to stay at rest. Something has to get it moving.

That something is a force. A force is a push or a pull. A force can be gentle, such as pulling this book toward you. Or a force can be tremendous[7], such as hot gases pushing out tons of rock from an erupting[8] volcano[9].

1.	inertia	*n.*	惯性
2.	tendency	*n.*	趋势
3.	resist	*v.*	抗拒
4.	force	*n.*	力
5.	effect	*n.*	作用；影响
6.	tend to		倾向
7.	tremendous	*adj.*	巨大的
8.	erupt	*v.*	喷发
9.	volcano	*n.*	火山
10.	marble	*n.*	大理石



A push from someone's hand moved the red marble[10]. What force is about to move the blue marble?

How do forces affect[1] motion? Think of a large ship. In order for the ship to start moving, force from huge propellers[2] has to overcome[3] the ship's inertia when it is standing still. When the propellers turn, the blades[4] push against the water and move the ship forward.

Friction[5]

Once the ship gets going, inertia makes it tend to keep going. But eventually[6] the ship has to slow down and stop. What force makes it do that? Mostly friction. Friction is a force that resists motion when two objects, such as the ship's hull[7] and the water, rub against each other. You can think of friction as the force of two objects pushing against each other.

Friction is always acting on the ship and slowing it down. When the propellers are turned off, the force they provide no longer exists. Now friction can slow the ship to a stop. As the ship approaches[8] the dock[9], it must be steered into position. It doesn't change direction by itself. It has to

1. affect	*v.*	影响
2. propeller	*n.*	螺旋桨
3. overcome	*v.*	克服
4. blade	*n.*	桨叶
5. friction	*n.*	摩擦力
6. eventually	*adv.*	最终
7. hull	*n.*	船体，船壳
8. approach	*v.*	接近
9. dock	*n.*	码头
10. diver	*n.*	跳水者，潜水员

Friction with the water changes the diver's[10] motion.

be forced to change. By turning the rudder[1] and propellers in different ways, pushes are exerted[2] on different areas of the water. These forces turn the ship to move forward in the desired[3] direction. On some ships, jets[4] along the side push the ship to the dock.

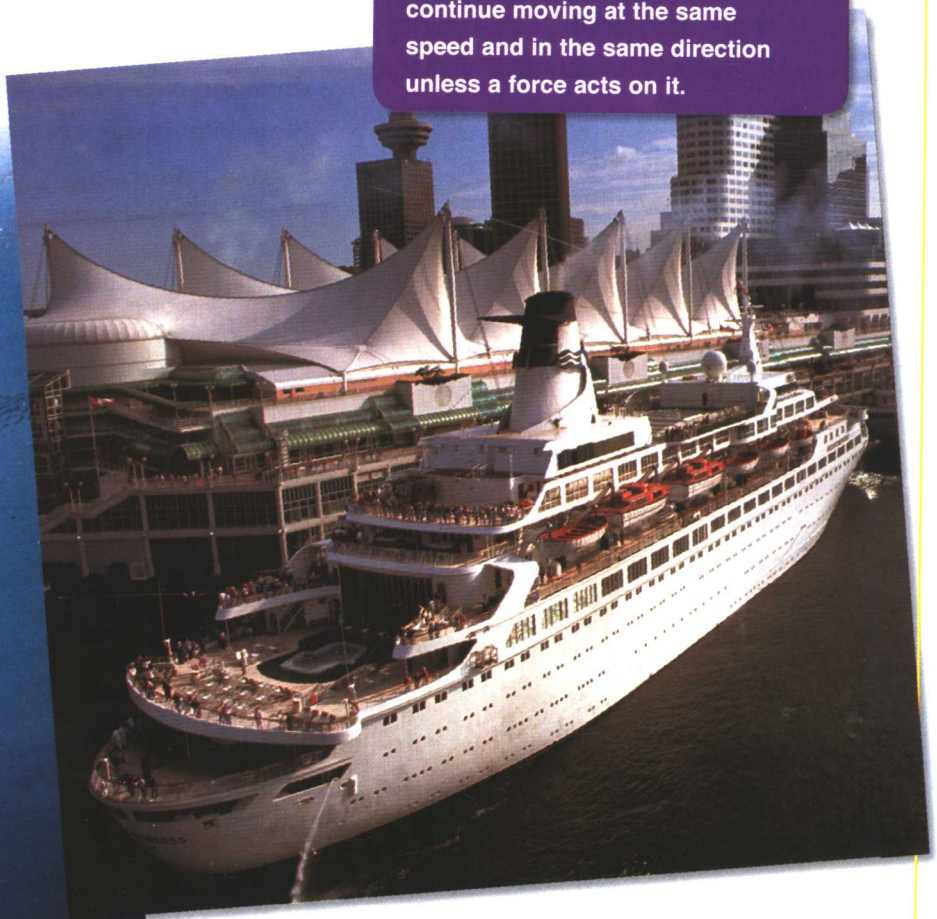
1. rudder *n.* （船的）舵
2. exert *v.* 施加
3. desired *adj.* 预期的
4. jet *n.* 喷气发动机

First Law of Motion

Isaac Newton stated these ideas about inertia and forces as his first law of motion. It's also called the law of inertia.

First Law of Motion

An object will remain at rest or continue moving at the same speed and in the same direction unless a force acts on it.



Different kinds of pushes steer this ship to the dock.

Force and Mass[1]

Problem: You and a friend want to move a dresser[2] from your parents' room to your room. The dresser has four drawers, and it's too heavy to move.

Solution[3]: Remove the drawers, and carry them one at a time. Then carry the empty dresser. Problem solved.

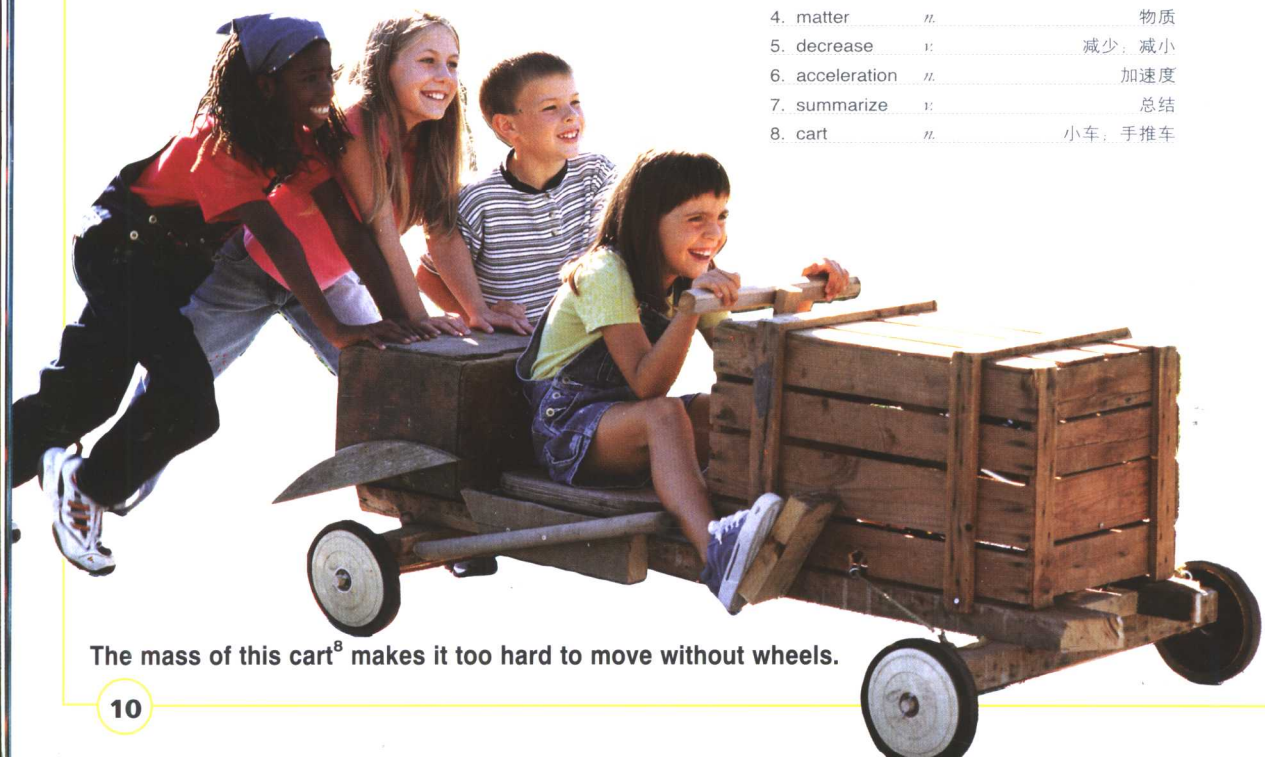
Let's look at the science behind that problem. The dresser was too heavy to move, even by two people, because of its large mass. Mass is the amount of matter[4] something has. You and your friend could not provide enough force to move that much mass. You could have moved it by adding more force. But no one else was around to provide the extra force. So instead you decreased[5] its mass. Each of you could provide plenty of force to move the mass of a drawer. Together you had enough force to move the empty dresser.

Can you tell that force and mass are related? Good. Now you're thinking like a scientist!

Second Law of Motion

Newton discovered that force, mass, and acceleration[6] are related. Acceleration is the change in an object's speed or direction over time. Newton summarized[7] the relationship between these ideas in his second law of motion.

1. mass	*n.*	质量
2. dresser	*n.*	带镜衣橱
3. solution	*n.*	解决办法
4. matter	*n.*	物质
5. decrease	*v.*	减少；减小
6. acceleration	*n.*	加速度
7. summarize	*v.*	总结
8. cart	*n.*	小车；手推车



The mass of this cart[8] makes it too hard to move without wheels.

That simple equation[1] is pretty amazing. It can tell you how much force is needed to move an object of a certain mass. Or it can tell how much a certain force will make an object move. It also can tell how much mass an object must have in order to move the way you want it to.

1. equation *n.* 等式
2. come in handy 派得上用处
3. predict *v.* 预计
4. javelin *n.* 标枪
5. endanger *v.* 危及
6. stadium *n.* 露天体育场
7. International Amateur Athletics Federation 国际业余田径总会

Second Law of Motion

An object's acceleration depends on the mass of the object and the size of the force acting on it. Newton wrote it this way:

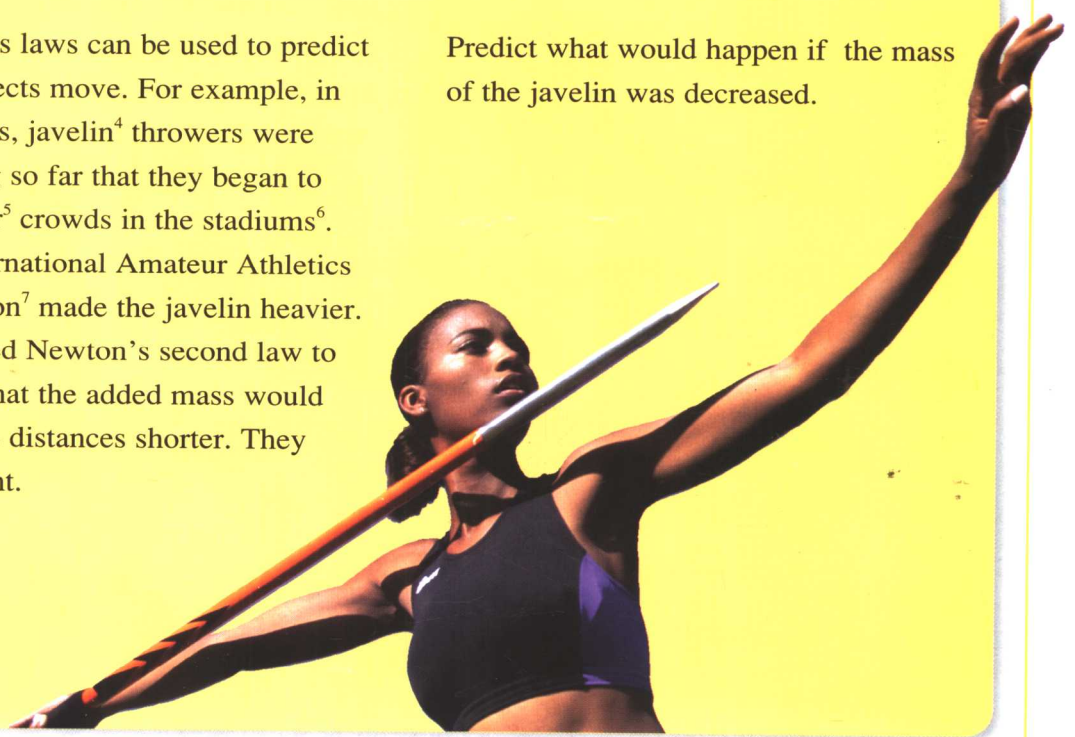
force = mass × acceleration

What is an example in your life when knowing the second law of motion could come in handy[2]?

Thinking Like a Scientist: Predicting[3]

Newton's laws can be used to predict how objects move. For example, in the 1980s, javelin[4] throwers were throwing so far that they began to endanger[5] crowds in the stadiums[6]. The International Amateur Athletics Federation[7] made the javelin heavier. They used Newton's second law to predict that the added mass would make the distances shorter. They were right.

Predict what would happen if the mass of the javelin was decreased.



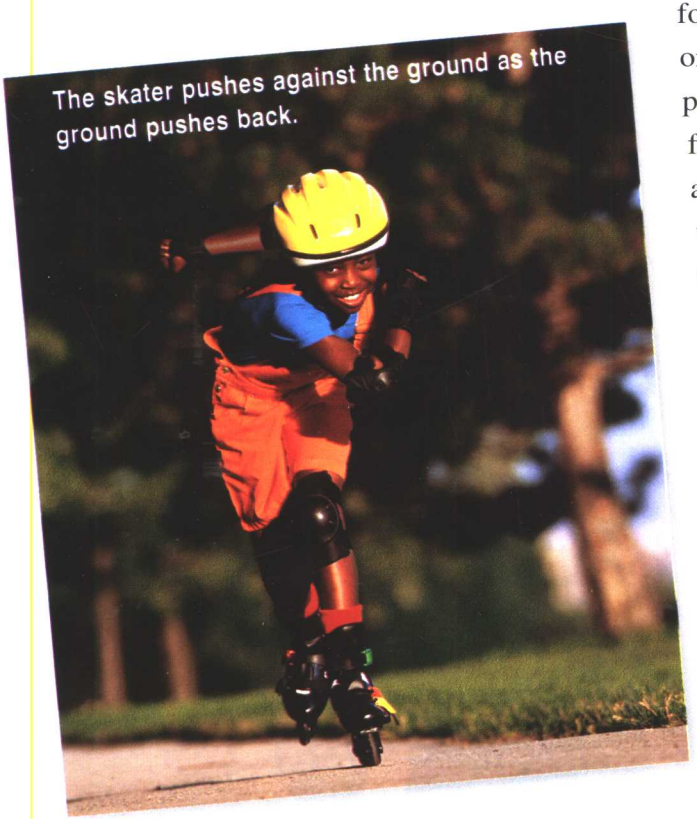
Pushing Back

You are trying to teach a friend how to ice skate for the first time. You give him a little push from behind to get him moving. He goes forward, but to your surprise, you are sent backward. You lose your balance[1] and take a little tumble[2]. Falling was not what you had planned. After all, *you* are the expert[3] skater! What happened? Well, your friend pushed back without even trying. Sound crazy? No, sounds like Newton's third law of motion.

Third Law of Motion

When one object exerts a force on a second object, the second object exerts a force of equal strength on the first object but in the opposite[7] direction. In other words, for every action, there is an equal and opposite reaction.

Newton figured out[4] that forces always work in pairs. One force is the action force[5]. The other is the reaction force[6]. The push you gave your friend on the ice was the action force. The push you received back was the reaction force. On the ship the propellers push against the water (action force). The water pushes back (reaction force), and the ship moves forward.



The skater pushes against the ground as the ground pushes back.

1. balance	*n.*	平衡
2. tumble	*n.*	跌跤
3. expert	*adj.*	熟练的
4. figure out		想出
5. action force		作用力
6. reaction force		反作用力
7. opposite	*adj.*	相反的
8. tilt	*v.*	倾斜

Suppose you pushed your friend while standing on grass instead of ice. You might tilt[8] backward a bit, but you probably would not move like you did on the ice. Why?

Tug-of-War[1]

The third law of motion is in action all around you. For example, when you walk, your feet push against the ground. The ground pushes back and moves you forward.

Sometimes it seems as if the action-reaction forces are not equal. Suppose you're sitting at a heavy desk doing homework. You grab[2] a small book and pull it toward you. The book is pulling on you with an equal force, as stated by the third law of motion. If that's true, why aren't you pulled toward the book? Because your mass is so much greater than the book's mass. Remember Newton's second law? The same force accelerates a small mass more than a large mass. You are pulled toward the book just a little, but not enough to notice. It's like a tug-of-war between you and the book, and you win easily!

But what happens when you pull on the heavy desk? The desk wins this tug-of-war. It pulls on you as you pull on it. Its mass is much greater than yours, however, so you move toward the desk.

The laws of motion are among the most important ideas in science. They explain the movement of everything—from tiny gas particles[3] in the air to huge planets in space. Figuring out these laws took a real genius[4].

1. tug-of-war *n.* 拔河（比赛）
2. grab *v.* 抓取
3. particle *n.* 微粒；颗粒
4. genius *n.* 天才；天资

These kids are pulling on the rope while being pulled by the other team.

Chapter 第二章 2

Isaac Newton:

Moving in a New Direction

牛顿：向新的方向前进