Gravity Rules

• Young skaters use science to nail new tricks.

Tristan and Nic Puehse are aces on skateboards. The 9-year-old twins speed up and down ramps, spin through the air, and pull off tricky stunts. They've done frontsiders and kickflips in China, and are just one rotation away from landing pro skater Tony Hawk's famous 900 trick—two and a half rotations in the air.

The twins' fancy footwork would make any science teacher proud. Science? That's right. After all, the boys' skateboarding tricks show off the basic principles, or laws, of science. Whether they know it or not, skaters pull off cool stunts by figuring out how fast they need to turn and the best way to balance their weight.

"If it's a difficult trick, you need to figure out the right speed and what angle," Nic told WR News. "Sometimes you need to get a lot of speed to clear a gap that's big," adds Tristan.

Fighting Gravity

One of the main forces skaters deal with during tricks is gravity. Gravity pulls objects together. On Earth, gravity pulls everything toward the planet's center.

Skaters often use gravity to help them get moving. When they start at the top of a ledge, for example, gravity pulls the board down toward the ground, sending skaters speeding across the ramp.

If they've built up enough energy when they reach the other side, they shoot into the air for a few seconds. "It's like flying," says Tristan. "But there's gravity, so you don't stay up there forever."

To move back up a ramp, skaters have to work against gravity. "You have to fight gravity to get from a low spot to a high one," physicist James Riordon explained to WR News. Riordon has been skateboarding since he was 7 years old.

Skaters use their centers of gravity to help them do that. The center of gravity is the spot where most of an object's weight is located. A human's center of gravity is the torso. Skaters bend their legs on the flat part of a ramp and straighten their legs on the inclines to take advantage of gravity. That movement raises and lowers the center of gravity, creating energy. The motion is similar to how you raise and lower your legs to get a swing moving.
Tricks with a Twist

Skaters do something similar with their arms and legs when turning. By tucking their arms in, they can spin faster because there is less resistance. "You can speed up your spin by pulling in your arms and legs or slow it down by spreading them out," Riordon says. Nic and Tristan pull their arms in tight for a 540--a trick that sends them rotating one and a half times in the air.

Skaters also use their centers of gravity to turn the skateboard. "Skateboards are designed to turn when your center of gravity is off to one side," says Riordon. If a skater's center of gravity ends up in front of or behind the board, the board will shoot out and he or she will likely fall. That's when a skater learns about gravity the hard way!

Think Critically

How do other athletes use their centers of gravity?

Board Basics

During an ollie, a skater launches into the air with the skateboard without touching the board with his or her hands. Here's how it works, step-by-step.

(See picture, "Diagram: Ollie Skateboarding Trick.")

Extreme Sports

Extreme sports, such as skateboarding, have taken the United States by storm. This graph shows the number of people who played an extreme sport in 2006. Study the graph, and then choose the best answers.

(See picture, "Graph: Extreme Sports.")

1. Which sport had the most participants?
   A. downhill skiing
   B. skateboarding
   C. in-line skating

2. Which sport had the fewest participants?
   A. snowboarding
   B. in-line skating
   C. downhill skiing

3. According to the bar graph, how many extreme sports had more than 6 million participants?
   A. three
   B. four
   C. five

4. How many more people went off-road mountain biking than snowboarding in 2006?
   A. 2.1 million
   B. 3.3 million
   C. 2 million
5. About _____ million fewer people went downhill skiing in 2006 than in-line skating.

A. 4.1  
B. 5.3  
C. 6.9

Before You Read

Ask students: How does a skateboard work? What might a person have to think about to stay balanced on a skateboard? How might studying science help skateboarders get better?

Vocabulary

center of gravity: the spot where most of an object’s weight is located

gravity: a force that pulls objects toward each other

principle: a basic law

tail: the back of a skateboard

Background

• How do Nic and Tristan Puehse come up with new tricks? The twins watch skateboarding movies, get tips from older skateboarders, and come up with some moves on their own. The twins showed off their skills in Shanghai, China, to promote a new skate park.

• Why do skaters use half-pipes? Skateboard ramps come in many shapes, but half-pipes are popular because they allow skaters to go back and forth without stopping—giving skaters plenty of chances to perform tricks.

• How does a skateboard’s design help skaters do tricks? Modern skateboards are typically made of thin layers of wood glued together. “That makes the boards strong and springy, a little like a diving board,” explains physicist James Riordon. The back of the board is angled upward, which makes it easier for skaters to push down on the back to do tricks such as ollies.

Think Critically

Tristan and Nic Puehse are much smaller than adult skateboarders. How might their small size be helpful for skateboarding tricks?

Extend the Lesson

Using a hardcover book in place of a skateboard, have students use their hands to re-create how a skateboard moves during an ollie. Ask: What would happen if the skater pushed down on the front of the board? What might happen if the skater pushed down too much on the board while it is in the air?

Web Resources

• For simple gravity experiments, visit www.exploratorium.edu/skateboarding.

• To learn more about Nic and Tristan Puehse, visit www.skateboardingtwins.com.
Get in Gear

Skateboarders often end up with bumps and bruises while working on new tricks. That's why even pros such as Tristan and Nic Puehse wear safety gear. This diagram shows the proper skateboarding gear and the estimated costs. Study the diagram. Then answer the questions below.

(See picture, "Diagram: Skateboarding Gear.")

1. How much does a helmet cost?
2. Which piece of gear protects a skater's hands?
3. Which two pieces of gear prevent slipping?
4. How much more do elbow and knee pads cost than wrist guards do?
5. What is the total cost of all the safety gear?

Get Writing: Which piece of gear is most important? Write a paragraph explaining your choice. Be sure to include at least two reasons supporting your opinion.

Answer Key

Extreme Sports


Get in Gear

1. $30; 2. gloves; 3. shoes, grip tape; 4. $30; 5. $146