Kinetic Energy

Physical Science | Lesson Guide

2nd Grade

Photo Description

A skateboarder is jumping into the air on a concrete skate park, balancing on their skateboard while their arms are spread wide for balance. The skateboard is below them, moving through the air. Other people are watching in the background, and you can see ramps and curved concrete features designed for skateboarding tricks.

Scientific Phenomena

Anchoring Phenomenon: A moving skateboard has energy that allows it to keep rolling, and a person's push-off creates motion.

Why This Happens: When the skateboarder pushes off with their feet, they transfer energy into the skateboard and themselves. This energy of motion is called kinetic energy. Objects that are moving have kinetic energy. The faster something moves, the more kinetic energy it has. Even while the skateboarder is in the air, both they and the skateboard are still moving because the energy they built up keeps them going until friction and gravity slow them down.

Core Science Concepts

* Motion and Speed: Things can move fast or slow. The skateboard and skateboarder are moving through space. We can describe how fast they're moving by observing how far they travel.

* Energy and Force: A push (force) from the skateboarder's legs creates motion. This push transfers energy to make things move. Moving objects have kinetic energy—the energy of motion.

* Gravity: Gravity pulls everything toward Earth. That's why the skateboarder comes back down after jumping. Gravity affects all moving objects.

* Friction: Friction is a force that slows things down. It happens when surfaces rub together. Friction between the skateboard wheels and the ground eventually stops the skateboard from rolling.

Pedagogical Tip:

When teaching kinetic energy to second graders, use the phrase "energy of motion" rather than the abstract term "kinetic energy" alone. Have students physically demonstrate the concept by running and stopping—they can feel the energy in their bodies and how it takes effort to slow down. This embodied learning makes the concept concrete and memorable.

UDL Suggestions:

To support diverse learners, provide multiple means of representation: show slow-motion videos of skateboarding, use visual diagrams with arrows showing movement direction, and allow students to physically act out motion concepts. For students with mobility differences, they can draw pictures of moving objects or use toys to demonstrate the same concepts. Offer choices in how students express their understanding—through movement, drawing, writing, or verbal explanation.

Zoom In / Zoom Out

Zoom In: The Atomic Level
When the skateboarder pushes off the ground, the molecules in their leg muscles are moving very, very fast—so fast you can't see them! These tiny particles are vibrating and bumping into each other, which creates the force that pushes the skateboard forward. The wheels of the skateboard are made of atoms too, and when those wheel atoms rub against the concrete atoms, friction happens. Friction is actually millions of tiny bumps and roughness on both surfaces rubbing together and slowing things down. Even though we can't see atoms, they're what make motion and friction happen!

Zoom Out: The Skate Park Ecosystem
The skate park is part of a larger community where many people gather to play, exercise, and have fun together. The concrete ramps and park were built by engineers and construction workers who had to understand how gravity and motion work to make it safe. The park needs sunshine for people to see and play during the day. Plants and trees around the park provide shade and clean air. Weather affects skateboarding too—on windy days, the skateboarder might move differently, and on rainy days, the concrete gets slippery due to water reducing friction. The skate park connects to the neighborhood's health and wellness, giving people a place to build strength and develop skills through movement.

Discussion Questions

1. What made the skateboard start moving? (Bloom's: Remember | DOK: 1)

2. Why do you think the skateboarder comes back down to the ground after jumping? (Bloom's: Understand | DOK: 2)

3. If the skate park had sand instead of concrete on the ground, what would happen to the skateboard? Why? (Bloom's: Analyze | DOK: 2)

4. How could we make the skateboard go faster or slower? What would we need to do? (Bloom's: Apply | DOK: 2)

Potential Student Misconceptions

Misconception 1: "The skateboard stops because it runs out of energy."
Clarification: The energy doesn't disappear—it transforms! When the skateboard slows down, the kinetic energy (energy of motion) changes into heat and sound energy. Friction between the wheels and the ground creates this heat. The energy is still there; it just changes into different forms we can sometimes see, feel, or hear (like the skateboard getting slightly warm or making a rolling sound).

Misconception 2: "Heavier skateboarders move faster than lighter ones."
Clarification: A heavier person and a lighter person can move at the same speed if they push with the same amount of force. However, a heavier object does need more force to get it moving and more friction to stop it. It's the force of the push that matters most for speed, not just the weight alone.

Misconception 3: "Gravity only works when something is falling down."
Clarification: Gravity is always pulling on objects—even when they're standing still or moving sideways! Gravity pulled the skateboarder down after the jump, but it's also pulling on the skateboard the whole time it's rolling on the ground. Gravity is constantly working, not just during jumps.

Extension Activities

1. Moving Objects Investigation: Give students toy cars, balls, and blocks on a smooth floor. Have them push each object and observe which ones move the farthest. Ask: "What made some objects move more than others? Did they all slow down? Why?" This connects to friction and kinetic energy transfer.

2. Ramp Race: Create simple ramps from cardboard and wood blocks. Have students roll different objects down the ramps and measure how far they travel using string or tape. Ask students to predict which object will go the farthest before slowing down. Discuss how the ramp's angle and height affect the object's speed and distance.

3. Freeze Dance Energy Game: Play music and have students dance and move (demonstrating kinetic energy). When the music stops, they must freeze quickly. Afterward, discuss: "When we were dancing, did we have energy of motion? What stopped our movement? How does friction help us stop?" This helps students feel kinetic energy in their own bodies.

Cross-Curricular Ideas

Math Connection: Measuring Distance and Speed
Have students use rulers, measuring tapes, or string to measure how far toy skateboards travel after being pushed different distances. Create a simple chart showing "Push Distance" versus "Roll Distance." Students can compare numbers and discuss: "Did pushing harder make it go farther? By how much?" This builds measurement skills and introduces the relationship between force and distance traveled.

ELA Connection: Action Words and Movement Stories
Read books about skateboarding and sports. Have students write or dictate short sentences using action verbs related to motion: "The skateboard zooms," "The skater jumps high," "The wheels roll fast." Create a classroom word wall with motion verbs (roll, slide, spin, bounce, jump, glide). Students can illustrate these words and act them out, building vocabulary while reinforcing kinetic energy concepts.

Social Studies Connection: Community Helpers and Safety
Discuss how skate parks are built and maintained by community workers (engineers, construction workers, safety inspectors). Talk about why safety gear like helmets is important—it protects us when moving fast due to kinetic energy. Visit or invite a local skate park designer or safety officer to share how they keep the community active and safe. This connects to civic responsibility and career awareness.

Art Connection: Motion in Visual Art
Have students create artwork showing motion using lines, arrows, and colors. They can draw a skateboard with "speed lines" behind it, or paint a picture of a skateboarder in action with blurred colors to show fast movement. Discuss how artists show movement on a still page using visual techniques. Students can also create a flip-book animation showing a skateboard rolling or a person jumping—each page shows a slightly different position to create the illusion of motion.

STEM Career Connection

Skateboard Designer/Engineer
Skateboard designers and engineers create new and better skateboards by thinking about how they move, how fast they go, and how safe they are. They test different shapes, wheel sizes, and materials to make skateboards that work great for tricks and stunts. They use science to understand friction, balance, and motion. If you love skateboarding and creating things, this job lets you make boards that other people enjoy! Average Annual Salary: $50,000–$75,000 USD

Sports Scientist or Biomechanist

Sports scientists study how people move their bodies when playing sports like skateboarding. They watch athletes jump, balance, and perform tricks, then use science to help them move better and avoid getting hurt. They might use cameras to film movement or design better safety gear like helmets and pads. These scientists help athletes understand the forces and energy in their bodies. Average Annual Salary: $45,000–$70,000 USD

Park and Recreation Planner
Park and recreation planners design skateparks and other play spaces for communities. They think about what equipment to include, where to put ramps, and how to keep everyone safe while having fun. They use science to understand how gravity and motion work on different designs, and they talk to skateboarders to learn what they need. If you like building cool spaces where people can play and be active, this job is for you! Average Annual Salary: $50,000–$68,000 USD

NGSS Connections

Performance Expectation: 2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Related Performance Expectation: K-PS2-1: Plan and conduct investigations to provide evidence that vibrations make sound and that vibrations can make objects move.

Disciplinary Core Ideas:
- 2-PS1.A—Different kinds of matter exist and can be described in different ways
- K-PS2.A—Objects can move in different ways, such as straight, zigzag, round, back-and-forth, and fast and slow

Crosscutting Concepts:
- Cause and Effect—Simple cause and effect relationships (push causes motion)
- Energy and Matter—Energy can be transferred in various ways

Science Vocabulary

* Kinetic Energy: The energy that something has when it is moving.

* Motion: The action of moving or changing position.

* Friction: A force that slows things down when two surfaces rub together.

* Gravity: An invisible force that pulls objects toward the ground.

* Force: A push or pull that makes something move or change direction.

* Speed: How fast something is moving.

External Resources

Children's Books:
- Push and Pull by Lola M. Schaefer (teaches forces and motion in accessible language)
- The Wheels on the Skateboard by Adria F. Klein (board sports and movement)
- Motion by Sian Smith (simple explanations of how things move)

Teacher Note: This lesson builds foundational understanding of motion and energy that will be expanded in later grades. Use real-world examples from students' lives (running, rolling toys, sliding on ice) to reinforce that kinetic energy is everywhere!