

Photo Description



A skateboarder in protective gear launches into the air while performing a trick at a concrete skate park. The skateboard separates from the rider's feet mid-jump, showing the moment when energy is transferred from the moving skateboarder to the skateboard. Other people and park structures are visible in the background on a sunny day.

Scientific Phenomena

Anchoring Phenomenon: How does a skateboarder launch into the air and why does the skateboard fly separately?

The Science Behind It: When the skateboarder pushes down and pulls up on the skateboard, they transfer their body's kinetic energy (energy of motion) to the skateboard. As the rider jumps, they and the board are moving forward together. At the moment of takeoff, the skateboarder's legs push the board downward and backward, creating an upward force that propels the rider into the air. Because of inertia—an object's tendency to keep moving in the same direction—the skateboard continues moving forward while the rider launches upward, causing them to separate. The skateboard has kinetic energy that keeps it moving even after leaving the rider's feet.

Core Science Concepts

1. **Kinetic Energy:** Energy that an object has because it is moving. The faster or heavier an object moves, the more kinetic energy it has. In this image, both the skateboarder and skateboard have kinetic energy.
2. **Force and Motion:** A force (push or pull) is needed to change how something moves. The skateboarder applies force to the skateboard by pushing down and pulling up, which changes the direction of motion and launches both the rider and board into the air.
3. **Inertia:** Objects in motion tend to stay in motion unless a force stops them. The skateboard keeps moving forward in the same direction even after the rider leaves it, because nothing is stopping it.
4. **Energy Transfer:** Energy can move from one object to another. When the skateboarder pushes on the skateboard, they transfer some of their body's energy to the board.

Pedagogical Tip:

Fourth graders learn best through observable, hands-on experiences with motion. Before discussing the skateboarding image, have students predict and test what happens when they push a toy car or skateboard with different amounts of force. This concrete experience builds understanding of the abstract concepts of kinetic energy and force. Start with the skateboard, then introduce the more complex idea of the rider's separation from it.

UDL Suggestions:

Representation: Provide a slow-motion video or multiple still images from different angles of the skateboard trick to help visual learners see the sequence of motion. Create a simplified diagram with arrows showing the direction of forces and motion.

Action & Expression: Allow students to demonstrate understanding by building a ramp with blocks and rolling toy skateboards at different speeds, or by creating their own motion diagrams with drawings and labels.

Engagement: Connect the skateboarding image to students' own experiences with bikes, scooters, or playground

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Discussion Questions

1. What is making the skateboard move forward through the air in this picture? (Bloom's: Understand | DOK: 1)
2. Why do you think the skateboarder and skateboard separate from each other during this trick? What forces are acting on each one? (Bloom's: Analyze | DOK: 2)
3. If the skateboarder pushed harder on the skateboard, how would that change the height of the jump and the distance the skateboard travels? (Bloom's: Apply | DOK: 2)
4. What would happen if the skateboarder tried this trick on a sandy beach instead of concrete? How would that change the kinetic energy and motion? (Bloom's: Evaluate | DOK: 3)

Extension Activities

1. Rolling Ramps Experiment: Students build ramps of different heights using blocks, books, or cardboard tubes. They roll toy skateboards, toy cars, or balls down the ramps and measure how far they travel. Students predict how changing the ramp height changes the object's speed and kinetic energy, then test their predictions. This directly models how the skateboarder's push creates motion.
2. Energy Transfer Game: Set up a "skateboard station" (or use toy boards) where students practice transferring energy by pushing toy skateboards of different weights with varying amounts of force. They measure the distance each skateboard travels and create a chart showing the relationship between force applied and distance traveled, building understanding of kinetic energy.
3. Design a Skateboard Park: Students work in small groups to design their own skate park using a large piece of paper or digital tool. They must include at least three different structures (ramps, jumps, rails) and write or draw explanations of how kinetic energy would help a skateboarder perform tricks on each structure. This combines engineering design with energy concepts.

NGSS Connections

Grade 4 Performance Expectation:

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Disciplinary Core Ideas:

- 4-PS3.A The relationship between object speed and kinetic energy
- 4-PS3.B The ways energy can be transferred (motion energy from skateboarder to skateboard)

Crosscutting Concepts:

- Energy and Matter Energy can be transferred between objects through forces
- Cause and Effect The force applied by the skateboarder causes changes in the motion of both the rider and the skateboard

Science Vocabulary

- * Kinetic Energy: The energy something has when it is moving; faster-moving or heavier objects have more kinetic energy.
- * Force: A push or pull that can make something move, stop moving, or change direction.
- * Motion: When something changes position or moves from one place to another.
- * Inertia: The tendency of a moving object to keep moving in the same direction unless a force stops it.

* Transfer: To move or pass something from one place or person to another.

External Resources

Children's Books:

- What is Energy? by Mary Wissinger (an introduction to different types of energy including kinetic energy)
- Motion by David Adler (explores speed, force, and how objects move)
- Push and Pull by David Evans (introduces forces and how they affect motion)

YouTube Videos:

- "What is Kinetic Energy? | National Geographic Kids," explains kinetic energy using real-world examples and animations:
<https://www.youtube.com/watch?v=W2hFHruRpqQ>
- "Ramp It Up: Forces and Motion," PBS Learning Media video showing how forces create motion through a skateboard ramp experiment: <https://www.youtube.com/watch?v=5hYB1J5k98Q>