# Force And Motion

Physical Science | Lesson Guide

2nd Grade

## Photo Description


A student in a red shirt is jumping over an orange cone on a grass field during an outdoor activity. The student's body is airborne, showing the moment of flight during a jump. Other students and adults are visible in the background, watching the activity take place.

## Scientific Phenomena

Anchoring Phenomenon: A student jumping and becoming temporarily airborne.

Why This Happens (Scientific Explanation): When the student pushes hard against the ground with their legs, they apply a force that propels their body upward. Once their feet leave the ground, gravity (an invisible force pulling things downward) gradually slows them down and brings them back to Earth. This demonstrates the relationship between force, motion, and gravity—core concepts in understanding how objects move.

## Core Science Concepts

1. Force: A push or pull that causes something to move, stop, or change direction. In this case, the student's leg muscles push against the ground.

2. Motion: The act of moving from one place to another. The jumping action shows motion in an upward direction, then downward.

3. Gravity: An invisible force that pulls objects toward Earth. It affects the student's ability to jump and determines when they land.

4. Speed and Direction: The student moves upward quickly (speed), demonstrating that forces have both magnitude and direction.

**Pedagogical Tip:**

Help students understand force and motion by using the language of "pushes and pulls." Ask them to identify which muscles are pushing during a jump. This concrete approach bridges abstract concepts to their own bodies and experiences.

**UDL Suggestions:**

Provide multiple means of engagement by allowing students to choose how they explore jumping: some students might prefer jumping over cones (kinesthetic), others might draw pictures of jumping (visual), and some might use action words to describe what they see (verbal). This honors diverse learning preferences while teaching the same concepts.

## Zoom In / Zoom Out

Zoom In: Muscle Cells at Work
When we zoom in really close to the student's legs, we can see tiny structures called muscle cells. These cells work together like a team of tiny workers. When the student decides to jump, their brain sends a message to these muscle cells, telling them to contract (tighten up). This happens so fast we can't see it! All those muscle cells squeezing together at the same time create the big force that pushes the student into the air.

Zoom Out: Playground as a Community Space
When we zoom out and look at the bigger picture, we see this jumping activity happening at a school or community playground. This space is part of a larger system where children come together to learn, play, and be healthy. The playground is designed with open grass areas, safe surfaces, and equipment (like the cone) to help students practice physical skills. The teachers and adults supervising ensure everyone stays safe. This shows how science learning connects to community spaces and how people work together to support children's growth.

## Discussion Questions

1. What made the student's body go up into the air? (Bloom's: Understand | DOK: 1)

2. Why did the student come back down to the ground? Could they stay in the air forever? (Bloom's: Analyze | DOK: 2)

3. If the student pushed even harder with their legs, what might happen to their jump? Why? (Bloom's: Predict/Apply | DOK: 3)

4. How is jumping over a cone different from jumping without an obstacle? What forces are involved in each? (Bloom's: Compare and Evaluate | DOK: 3)

## Potential Student Misconceptions

Misconception 1: "Gravity only pulls things down after they're already falling."
Clarification: Gravity is always pulling on the student—even before they jump, while they're in the air, and after they land. Gravity doesn't wait for something to fall; it's constantly pulling everything toward Earth. When the student jumps, their leg muscles are strong enough to push them up against gravity for a moment, but gravity keeps pulling the whole time, eventually bringing them back down.

Misconception 2: "The student stays in the air because they keep pushing."
Clarification: Once the student's feet leave the ground, they stop pushing. The push only happens when their feet are touching the ground. Once they're airborne, only gravity is acting on them, pulling them back down. The student can't keep pushing while floating in the air!

Misconception 3: "Bigger people always jump higher than smaller people."
Clarification: While it's true that some bigger people might jump higher, it's not automatic. How high someone jumps depends on how much force they can create by pushing with their leg muscles, not just their size. A smaller person who practices and uses strong leg muscles might jump higher than a bigger person who doesn't push as hard.

## Extension Activities

1. Jump Challenges: Set up a safe obstacle course with cones at different distances. Have students predict whether they can jump over each cone, then test their predictions. Record data about which jumps were successful and why (strength, distance, practice).

2. Force Detective Walk: Take students on a "force walk" around the classroom and playground. Have them identify and label examples of pushes and pulls they see (doors opening, balls rolling, swings moving). Create a class poster of all the forces they discover.

3. Design a Jump: Provide students with cardboard tubes, tape, and paper to design their own "jumping machine" or springy device using their understanding of how forces create motion. Test which designs allow objects to jump the farthest.

## Cross-Curricular Ideas

Math Connection: Measuring Jumps
Have students jump and measure how far they traveled using non-standard units (like footprints or blocks) and then standard units (inches or centimeters). Create a class chart showing each student's jump distance. Students can compare distances, order them from shortest to longest, and solve simple word problems: "If Maya jumped 24 inches and Tom jumped 18 inches, how much farther did Maya jump?"

ELA Connection: Action Words and Jump Stories
Read jump-related picture books like Jump, Frog, Jump! and discuss action verbs (jumped, soared, landed, bounced). Have students write or draw their own jump story using descriptive words. They might write: "I pushed hard with my legs. I soared through the air. I jumped over the orange cone!" This connects vocabulary and motion together.

Art Connection: Motion in Art
Have students create artwork showing the jumping sequence using drawings or collage. They could illustrate three moments: before the jump (bending legs), during the jump (airborne), and after the jump (landing). This helps them visualize the different stages of motion and understand that jumping is a process, not just one moment.

Social Studies Connection: Games Around the World
Explore jumping games and activities from different cultures (like hopscotch, jump rope games, or traditional folk dances that include jumping). Discuss how people around the world use jumping in play and celebration. This connects physical science to cultural practices and shows that force and motion are used in many different ways across communities.

## STEM Career Connection

Physical Education Teacher or Coach
These professionals teach students how to move their bodies safely and skillfully through sports and games—like the jumping activity in this photo! They use their knowledge of forces, motion, and human bodies to help children develop strength, balance, and confidence. They design activities and obstacle courses that challenge students and keep them healthy.
Average Annual Salary: $60,000–$70,000 USD

Sports Scientist or Biomechanist
These scientists study how bodies move during sports and exercise. They use cameras, computers, and measurements to understand things like how high someone can jump, what forces their muscles create, and how to help athletes jump better or run faster. They might work with Olympic athletes or help design better sports equipment!
Average Annual Salary: $58,000–$75,000 USD

Physical Therapist
Physical therapists help people who are injured or have difficulty moving. They understand how muscles, bones, and forces work together. If a student hurt their leg and couldn't jump anymore, a physical therapist would help them regain strength and motion through exercises and guided activities. They use science to help people move better and feel better.

Average Annual Salary: $88,000–$95,000 USD

## NGSS Connections

Performance Expectation:
K-PS2-1: Plan and conduct an investigation to provide evidence that a push or a pull can change the speed or direction of an object's motion. (NGSS Grade K—foundational; appropriate for Grade 2 application and extension)

Disciplinary Core Ideas:
- K-PS2.A Forces and Motion
- K-PS2.B Types of Forces

Crosscutting Concepts:
- Cause and Effect
- Energy and Matter

---

## Science Vocabulary

* Force: A push or pull that makes something move, stop, or change direction.
* Jump: To push off the ground with your legs and move through the air.
* Gravity: An invisible force that pulls things downward toward Earth.
* Motion: The act of moving or changing position.
* Speed: How fast something is moving.
* Direction: The way something is moving (up, down, left, right, forward, backward).

## External Resources

Children's Books:
- Push and Pull by Lola M. Schaefer (Heinemann Library)
- Jump, Frog, Jump! by Robert Kalan, illustrated by Byron Barton (Greenwillow Books)
- Forces Make Things Move by Kimberly Bradley (HarperCollins)

---

Teacher Tip: This jumping activity is excellent for kinesthetic learners and connects directly to students' own bodies. Consider having students jump in a designated outdoor area with proper supervision and plenty of space to ensure safety.