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Even young children understand that Superman has enough force to stop a moving train or alter the direction of an asteroid, but a true understanding of what force is exactly may be elusive. The books in this annotated bibliography provide a solid introduction to the ups and downs of forces and the three laws of motion, developed by Sir Isaac Newton. A section featuring experiment-oriented books allows students to explore and test their understanding, and for children who wonder about extreme forces or ways to manipulate forces, there are also books to satisfy their curiosity.

Understanding Forces and Motion

And Everyone Shouted, "Pull!" A First Look at Forces and Motion. By Claire Llewellyn. Illus. by Simone Abel. 2004. 32p. Picture Window, lib. ed., $16.95 (9781404806566). 531.6. PreS–Gr. 2.

Adorable farm animals wonder how they'll take their goods to the market in this picture book. They have a cart to help, but they still need a push or pull to get them moving. Their path, which takes them up and down hills, around a fallen tree, and straight through thick mud, provides opportunities to discuss forces and motion. A concluding section recaps the forces used on the trip.

A Crash Course in Forces and Motion with Max Axiom, Super Scientist. By Emily Sohn. Illus. by Steve Erwin and Charles Barnett. 2007. 32p. Capstone, lib. ed., $29.99 (9780736868372); paper, $7.95 (9780736878906); e-book, $29.99 (9780736875691). 531.11. Gr. 4–7.

An amusement park is the perfect setting for ultracool super scientist Max Axiom to explore forces and motion in this graphic-novel-style entry in the Graphic Science series. For instance, a roller-coaster ride helps explain inertia and Newton's second law of motion, while the swing ride is a good example of centripetal force. A list of related facts concludes the action-packed book.

Forces and Motion: A Question and Answer Book. By Catherine A. Welch. 2006. 32p. illus. Capstone, lib. ed., $19.99 (9780736854450); paper, $7.95 (9781429602235). 531.6. Gr. 2–4.

Practical questions—"How do trampolines make people bounce?" "Why do many highway accidents involve trucks?"—and their answers explain force, inertia, gravity, resistance, and other related physical-science concepts. High-interest sidebars on topics such as why skydivers spread out their arms and legs to increase air resistance complement this title in the Fact Finders series.

Forces Make Things Move. By Kimberly Brubaker Bradley. Illus. by Paul Meisel. 2005. 40p. HarperCollins, paper, $5.99 (9780064452144). 531. Gr. 1–3.

This volume from the Let's-Read-and-Find-Out series starts with pushing toy cars across the floor and gradually introduces ideas such as forces, reactions, inertia, friction, and gravity. Humor enlivens the text, while colorful illustrations brighten the pages. The final spread offers instructions for a simple activity leading to a better understanding of friction.

Friction and Gravity: Snowboarding Science. By Marcus Figorito. 2009. 32p. illus. Rosen/PowerKids, lib. ed., $25.25 (9781435829954); paper, $10 (9781435801851); e-book, $25.25 (9781435858589). 531. Gr. 4–6.

Complemented by photos of snowboarders in action, this book uses the sport of snowboarding as a framework to introduce friction and gravity. As the author integrates the scientific principles into the text, he explains how snowboarders must overcome friction and gravity to create their death-defying tricks. Snowboarding lingo and profiles of famous snowboarders add further interest.

Galileo's Leaning Tower Experiment. By Wendy Macdonald. Illus. by Paolo Rui. 2009. 32p. Charlesbridge, $16.95 (9781570918698); paper, $7.95 (9781570918704). 531.5. Gr. 3–5.

In this title, illustrated with dramatic acrylic paintings, Galileo, a professor in Pisa, spies a boy dropping food off a bridge into a boat below and notices that the bread and meat land at the same instant. He and the boy set out to upend Aristotle's theory of gravity and prove that objects fall at a uniform speed no matter their weight by rolling different balls off the Leaning Tower.

Give It a Push! Give It a Pull! A Look at Forces. By Jennifer Boothroyd. 2010. 32p. illus. Lerner, lib. ed., $25.26 (9780761354314); paper, $7.95 (9780761360568); e-book, $38.60 (9780761362975). 531.6. Gr. 1–3.

Accompanied by color photos of children and athletes in action, this Lightning Bolt book simplifies concepts about forces and motion for young children. Beginning with the explanation that "a force is a push or a pull," the text goes on to describe how forces put things in motion, change the speed of things, and even make things stop. Boothroyd also covers the relationship of weight and friction to force.

Gravity Is a Mystery. By Franklyn M. Branley. Illus. by Edward Miller. 2007. 40p. HarperCollins, paper, $5.99 (9780064452014). 531. Gr. 1–3.

This volume in the Let's-Read-and-Find-Out series imagines what would happen if one dug a hole from one end of the earth to the other. After describing how gravity would pull to the center, the text explains how gravity on different planets would affect one's weight. A 60-pound child, for example, would weigh 142 pounds on Jupiter but only 23 pounds on Mercury.

Gut-Wrenching Gravity and Other Fatal Forces. By Anna Claybourne. 2013. 32p. illus. Crabtree, lib. ed., $27.60 (9780778709503); paper, $9.95 (9780778709572). 531. Gr. 3–6.

Part of the Disgusting & Dreadful Science series, this title supplies basic information about gravity through snazzily designed pages, short patches of creatively arranged text, colorful illustrations, and plenty of white space. Facts that run from the amazing to the gross—a mouse can survive a 328-foot fall; space toilets keep waste from floating in space—make this a high-interest read.

I, Galileo. By Bonnie Christensen. Illus. by the author. 2012. 40p. Knopf, $17.99 (9780375867538); lib. ed., $20.99 (9780375967535). 520.92. Gr. 3–5.

A blind, elderly Galileo sits in his walled garden and tells the story of his life in this handsomely illustrated picture-book biography. After speaking of his childhood and education, he recalls his scientific work, including his Leaning Tower of Pisa experiment, in which he proved that objects of different masses fall at the same acceleration and disproved Aristotle's theory of gravity.

Isaac Newton. By Kathleen Krull. Illus. by Boris Kulikov. 2006. 128p. Viking, $15.99 (9780670059218); paper, $5.99 (9780142408209); e-book, $5.99 (9781101098363). 530. Gr. 5–8.

Krull's conversational style illuminates Isaac Newton's personality and makes the scientist's complex theories and laws of physics easier to understand in this Giants of Science biography. Humorous pen-and-ink drawings complement the lighthearted text, which depicts Newton as disagreeable and difficult but never boring. See also Dennis Brindell Fradin's *With a Little Luck: Surprising Stories of Amazing Discovery* (2006).

Isaac Newton. By Philip Steele. 2007. 64p. illus. National Geographic, $17.95 (9781426301148); lib. ed., $27.90 (9781426301155); paper, $7.99 (9781426314506). 530.092. Gr. 4–7.

Vivid descriptions of Newton's life make up this National Geographic World History Biographies title. The cradle-to-grave text includes Newton's early work with a new branch of science now known as physics, including his experiments with gravity, as well as his later publication of his three laws of motion. A dynamic format, with archival images, enlivens the text. See also Laurie Purdie Salas' *Discovering Nature's Laws: A Story about Isaac Newton* (2004).

Why Do Elephants Need the Sun? By Robert E. Wells. Illus. by the author. 2010. 32p. Albert Whitman, $16.99 (9780807590812); paper, $7.99 (9780807590829). 599.67. Gr. 2–4.

This nonfiction picture book explains the importance of the sun and uses a male African elephant, the earth's biggest land animal, to establish key facts and comparisons. Several spreads discuss gravity and mass, including why gravity pulls on an elephant with more force than a baboon. Child-friendly pen-and-acrylic illustrations make the clear text even more accessible.

Zombies and Forces and Motion. By Mark Weakland. Illus. by Gervasio. 2011. 32p. Capstone, $29.32 (9781429665773); paper, $7.95 (9781429673358); e-book, $36.99 (9781476503097). 531. Gr. 4–7.

Told in a graphic-novel format using comics (and comical) panels, this physics-zombie mash-up examines Newton's three laws of motion. For instance, the momentum of two teenagers' heavy, fast car will allow them to outpace an attacking zombie—unless the zombie has a greater acceleration. Other zombie dilemmas involve force, mass, inertia, and other physics-related topics.

Experimenting with Forces and Motion

Balance and Motion: Toying with Gravity. By Emily Sohn and Joseph Brennan. 2011. 24p. illus. Norwood, lib. ed., $15.95 (9781599534053); paper, $8.95 (9781603573030); e-book, $35.88 (9781603573283). 531. Gr. 2–5.

An opening puzzle in this iScience Readers book offers three simple, easily testable options for improving a toy acrobat's balance. Explanations of balance, gravity, and stability, as well as guided questions, offer assistance in solving the puzzle. Additional questions (e.g., "Why might it be hard to run on a tightrope?") and a supplemental puzzle encourage further exploration of the concepts.

Experiments with Force and Motion. By Colin Uttley. 2010. 32p. illus. Gareth Stevens, $28 (9781433934599); paper, $10.50 (9781433934605). 531. Gr. 4–7.

This entry in the Cool Science series begins with a cursory introduction to forces and motion. The text continues with experiments that investigate both Newton's laws of motion and how simple machines affect force (e.g., why less force is needed to lift a load when a ramp is used). "Troubleshooting" tips, related facts, and photos of children performing the experiments aid the scientific process.

Experiments with Motion. By Susan H. Gray. 2011. 48p. illus. Scholastic, lib. ed., $29 (9780531263464); paper, $6.95 (9780531266465). 531. Gr. 4–6.

After an introduction to the scientific method, a combination of text and experiments, which follow the scientific method and only require common items, provides readers with a way to delve into Newton's laws of motion. Each experiment's "Conclusion" allows students to verify their hypotheses. Crisp color photos, sidebars, statistics, and a time line keep this True Book title lively.

Fall Down. By Vicki Cobb. Illus. by Julia Gorton. 2004. 40p. HarperCollins, $17.99 (9780688178420); lib. ed., $17.99 (9780688178437). 531. PreS–Gr. 1.

Part of the Science Play series, this book begins with instructions for adults to gather simple materials needed for the gravity exercises. The main text encourages experimental play with gravity, such as tossing different objects into the air and observing comparative speeds at which they fall. Cobb's questions and suggestions also draw kids into the scientific process.

Isaac Newton and Physics for Kids: His Life and Ideas with 21 Activities. By Kerrie Logan Hollihan. 2009. 144p. illus. Chicago Review, paper, $16.95 (9781556527784); e-book, $13.99 (9781613742129). 530.092. Gr. 4–8.

Hollihan introduces readers to the scientific brilliance, as well as the social isolation, of Isaac Newton, whose questions and subsequent answers made a mark on the study of physics. The author blends a thorough and readable narrative with an attractive format that incorporates maps, diagrams, historical photographs, reproductions, and physics activities (several of which study forces).

Motion. By Ellen Lawrence. 2013. 24p. illus. Bearport, lib. ed., $23.93 (9781617727399); e-book, $30.60 (9781617727887). 531. Gr. 1–3.

After a brief introduction to motion, this Fundamental Experiments title uses experiments involving common household items (string, toy cars, baseballs, etc.) to answer such questions as "Does it take more force to move heavy objects?" Along the way, students learn about types of force, friction, and gravity. A concluding section, with real-life scenarios, reinforces the concepts covered.

Motion, Magnets and More: The Big Book of Primary Physical Science. By Adrienne Mason. Illus. by Claudia Dávila. 2011. 128p. Kids Can, $18.95 (9781554537075). 500.2. K–Gr. 2

Illustrated with energetic digital artwork, this primer tackles four broad categories of physical science: materials, structures, states of matter, and forces of motion. The topics are presented through observations, brief scientific explanations, and experimental activities using classroom staples. More detailed methodological notes specifically for adults are included as an appendix.

What Are Forces and Motion? By Richard Spilsbury and Louise Spilsbury. 2008. 32p. illus. Enslow, $22.60 (9780766030954). 531.
Gr. 3–5.

Following explanations of Newton's three laws of motion, how simple machines requiring less force, responding to buoyant force, and building with force, seven experiments (using common items) allow students to explore these topics in more detail. Diagrams and photos of children performing the experiments aid comprehension and the scientific process. For older students, suggest Robert Gardner's *Forces and Motion Science Fair Projects* (2010).

Defying Forces and Motion

A Black Hole Is Not a Hole. By Carolyn Cinami DeCristofano. Illus. by Michael Carroll. 2012. 80p. Charlesbridge, $18.95 (9781570917837). 523.8. Gr. 4–7.

Witty yet thorough text provides an engaging investigation of black holes. Stunning photographs and artistic representations add extra flair as the author relates these phenomena to Newton's laws of motion and describes a black hole's "extreme case of gravity." Pair this with Ellen Jackson and Nic Bishop's *The Mysterious Universe: Supernovae, Dark Energy, and Black Holes* (2008).

Simon Bloom, the Gravity Keeper. By Michael Reisman. 2008. 256p. Puffin, paper, $8.99 (9780142413685); e-book, $8.99 (9781101200704). Gr. 4–7.

In this science-fiction adventure, Simon Bloom, 11, discovers a hidden forest in the middle of his New Jersey town. There he receives a physics book filled with scientific formulas, which he figures out how to use, much like magic spells. With his increasing skills, such as learning to control gravity and friction, Simon and his friends fight a mysterious woman who is trying to take over the world.

Zathura. By Chris Van Allsburg. Illus. by the author. 2002. 32p. Houghton, $18 (9780618253968). K–Gr. 3.

Havoc returns in this sequel to Van Allsburg's *Jumanji* (1981). When Danny and Walter find the magical game box in the park, they discover a second game board inside, decorated with space images. Like the children in *Jumanji*, they are instantly catapulted into the game's parallel universe, which this time involves wild shifts in gravity and a black hole that loops the brothers back to the park.

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Common Core Connections: Forces and Motion

Implement the Common Core State Standards with these activities, drawn from notable books for youth about forces and motion, that offer hands-on opportunities for elementary-school students to explore basic scientific concepts.

In the Classroom: Even very young children can begin to understand how weight affects force by trying the related activity in Vicki Cobb's *I Fall Down*. After reading the book as a class, have one student drop a sponge and a bar of soap into another student's hands. Ask the receiving student to determine which item hits his or her hands harder or with more force, and then discuss how the activity connects to the concepts in Cobb's book.

Common Core Connections

- **CCSS.ELA-Literacy.RI.K.1.** With prompting and support, ask and answer questions about key details in a text.
- **CCSS.ELA-Literacy.RI.K.2.** With prompting and support, identify the main topic and retell key details of a text.

In the Classroom: After students have read Ellen Lawrence's *Motion*, have them perform the experiment "Does It Take More Force to Move Heavy Objects?" Ask them to line up a toy car, a cotton ball, a leaf, and a stone at one end of a table. Then, have them try to move the objects by blowing on them through a straw (a type of push) and record which objects traveled farthest and why. Then, referring back to Lawrence's text, discuss which concepts were demonstrated in the experiment.

Common Core Connections

- **CCSS.ELA-Literacy.RI.3.3.** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- **CCSS.ELA-Literacy.RI.3.8.** Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).

In the Classroom: In *Motion, Magnets and More*, by Claudia Dávila, children can discover how friction works through the "Sliding Along" activity suggested in the book. After they line up an ice cube, a wooden block, and other various objects on the end of a bread board, carefully lift up the board to see which objects slide faster than others. Then, ask students to return to *Motion, Magnets and More* to find definitions for the concepts demonstrated in the activity.

Common Core Connections

- **CCSS.ELA-Literacy.RI.1.4.** Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
- **CCSS.ELA-Literacy.RI.1.5.** Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.

In the Classroom: After reading Franklyn M. Branley's *Gravity Is a Mystery*, students can perform the concluding activity to see how gravity works. As they drop marbles, baseballs, paper, and other items at the same time, they will observe how gravity remains the same, but the size and shape of an object can affect its speed.

Common Core Connections

- **CCSS.ELA-Literacy.RI.1.4.** Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
- **CCSS.ELA-Literacy.SL.2.2.** Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

In the Classroom: To figure out the relationship between gravity and balance, students can solve the "iScience Puzzle" in *Balance and Motion*, by Emily Sohn and Joseph Brennan. Divide the class into groups to carry out the activity, which directs students to make a toy acrobat and determine whether a straight pole, a pole bent upside down, or a pole bent right side up will make the toy balance. After completing the experiment, have the groups report back to the class about their findings.

Common Core Connections

- **CCSS.ELA-Literacy.SL.4.4.** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- **CCSS.ELA-Literacy.SL.4.6.** Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation.
- **CCSS.ELA-Literacy.RI.5.3.** Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

In the Classroom: Students can see how inertia works through the "Spin the Bottle" experiment in Susan H. Gray's *Experiments with Motion*. After shaking a bottle of salad dressing, they swing the container in a circle with the help of a string and observe whether the contents in the bottle separated or remained mixed. Follow the experiment with a discussion, based on Gray's text, of the scientific concepts demonstrated in the experiment.

Common Core Connections

- **CCSS.ELA-Literacy.RI.5.3.** Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- **CCSS.ELA-Literacy.RI.5.8.** Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).

In the Classroom: Have students refer to Kerrie Logan Hollihan's *Isaac Newton and Physics for Kids* to carry out an activity, connected to Newton's third law of motion, that asks students to observe how letting the air out of a balloon makes the balloon move. Students can investigate the same action further with a balloon placed inside a handmade boat, as described in Hollihan's text. After the activities, discuss with students which forces of motion were demonstrated, citing definitions from Hollihan's text to reinforce their statements.

Common Core Connections

- **CCSS.ELA-Literacy.RI.4.3.** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- **CCSS.ELA-Literacy.RI.5.1.** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.