

START HERE

Amplify Science

Grade 3

Instructional sampler



A large, stylized purple graphic that resembles a hand or a wing, with a curved, open shape at the top and a long, tapering arm extending towards the bottom right.

Amplify.



THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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Suggested review experience

Welcome to Amplify Science! In your program sample, you'll find resources and program materials to help you in your review. We recommend exploring the materials in the following order:



1. Instructional sampler

This is what you're holding in your hands right now. The instructional sampler gives you high-level insights into the program's development and approach, information about the various program materials, and a step-by-step walkthrough of how to dig into the online experience for a thorough review.



2. Student print materials

Review the student print materials included in your sample. In this box, you have all of the print student materials used over the course of the year, including Student Investigation Notebooks and Student Books.



3. Exemplar print Teacher's Guide

Review the Teacher's Guide included in the box. The print Teacher's Guide is a printed version of the digital Teacher's Guide and allows you to plan for and deliver most instruction in the program. You'll need to access certain materials for instruction (projections, videos, etc.) via the digital Teacher's Guide.



4. Digital Teacher's Guide

Explore the digital version of the Teacher's Guide, as well as other program features, by visiting amplify.com/sciencek5. A guided tour will familiarize you with navigating the program and its features.

amplify.com/sciencek5

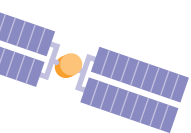


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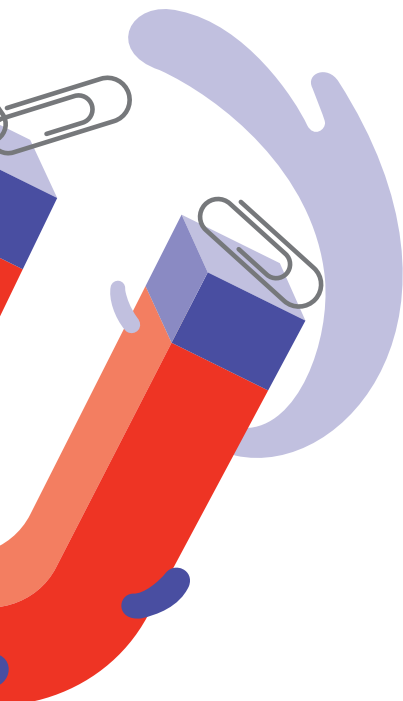
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About Amplify Science

In every unit of Amplify Science, students take on the roles of scientists and engineers to figure out real-world phenomena. Students actively investigate compelling questions by finding and evaluating evidence then developing convincing arguments.

In an Amplify Science classroom, students:

- ✓ Collect evidence from a variety of sources.
- ✓ Make sense of evidence in a variety of ways.
- ✓ Formulate convincing scientific arguments.

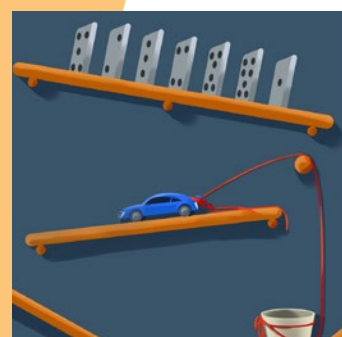
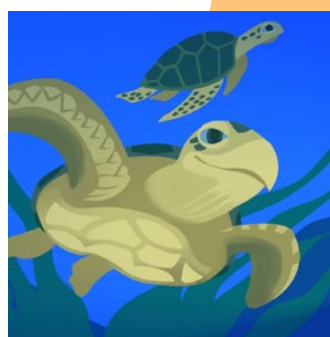


Built for new science standards and three-dimensional learning

The Next Generation Science Standards have raised the bar in science education. We set out to create a science program that educators can leverage to bring three-dimensional learning to life for their students. Educators who adopt Amplify Science have access to a comprehensive curriculum complete with detailed lesson plans, hands-on activities and materials, digital tools, embedded assessments, and robust teacher supports.

Amplify Science meets higher expectations for science teaching and learning:

- Anchor phenomena, explored through diverse interdisciplinary contexts, serve as the foundation for compelling, coherent storylines.
- Research-based multimodal learning allows students to develop expertise in all **Science and Engineering Practices (SEPs)** and deep understanding of **Disciplinary Core Ideas (DCIs)** and **Crosscutting Concepts (CCCs)** through experiences within a wide variety of contexts.
- Modeling tools enable students to create, and later revise, visualizations of their ideas of key scientific phenomena at critical points in the curriculum.
- Embedded engineering in units focused on engineering and technology emphasize that there's not always one right answer, as students balance competing constraints to design the best justifiable solutions.



A powerful partnership



UC Berkeley’s Lawrence Hall of Science has more than 40 years of experience improving K–12 science education. With 20 percent of K–12 classrooms using a Hall-developed instructional resource, and with legacy programs that include FOSS®, Seeds of Science/Roots of Reading®, GEMS®, SEPUP, and Ocean Science Sequences, the Hall’s team has a deep understanding of what makes programs effective.

As the Hall’s first K–5 science curriculum designed to address the new science standards, Amplify Science reflects state-of-the-art practices in science teaching and learning. Amplify’s partnership with LHS runs through 2032 to ensure the program is continually enhanced and updated.



Amplify.

A pioneer in K–12 education since 2000, Amplify is leading the way in next-generation curriculum and assessment. Our captivating core and supplemental programs in ELA, math, and science engage all students in rigorous learning and inspire them to think deeply, creatively, and for themselves. Our formative assessment products turn data into practical instructional support to help all students build a strong foundation in early reading and math. All of our programs provide teachers with powerful tools that help them understand and respond to the needs of every student. Today, Amplify serves five million students in all 50 states.

Hear from our program authors



For 15 years, I've been fortunate to lead an outstanding team of scientists and educators as director of the Learning Design Group at UC Berkeley's Lawrence Hall of Science. We are extremely proud of Amplify Science and appreciate your taking the time to review the program. We developed Amplify Science to reflect the latest thinking and research about science teaching and learning. Along the way, we undertook extensive field testing to ensure our new program works well in real classrooms, with real students and teachers.

I think you'll find that Amplify Science stands apart from other elementary school science programs in the following ways: a research-based, multimodal pedagogical approach where students learn to think like scientists and engineers by investigating real-world problems; a balanced blend of hands-on, digital, and literacy activities that are highly engaging and effective; embedded assessments that support differentiation for diverse learners; and robust teacher support for successful implementation. I hope you enjoy exploring the curriculum as much as we enjoyed creating it.

Sincerely,

A handwritten signature in black ink that reads "Jacqueline Barber".

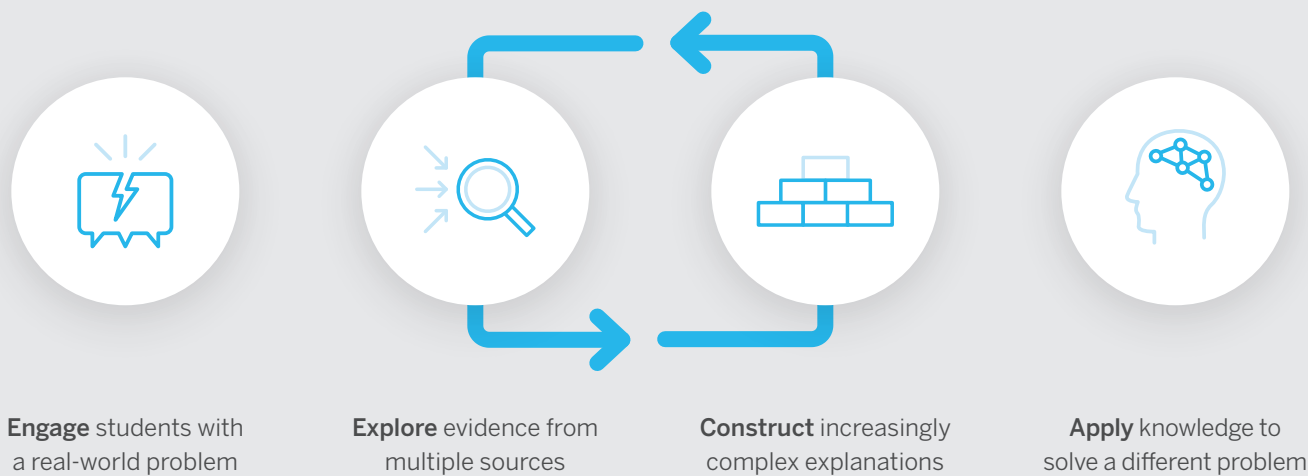
Jacqueline Barber

Director, Learning Design Group,
Lawrence Hall of Science

A unique, phenomena-based approach

In each Amplify Science unit, students inhabit the role of a scientist or engineer in order to investigate a real-world problem. These problems provide relevant, 21st-century contexts through which students investigate different scientific phenomena.

To investigate these phenomena, students collect evidence from multiple sources and through a variety of modalities. They move back and forth from firsthand investigation to secondhand analysis and synthesis, formulating an increasingly complex explanation of the target phenomenon. Each unit also provides students with opportunities to apply what they have learned to solve new problems in different contexts. This enables students to demonstrate a deep understanding of phenomena and practices.



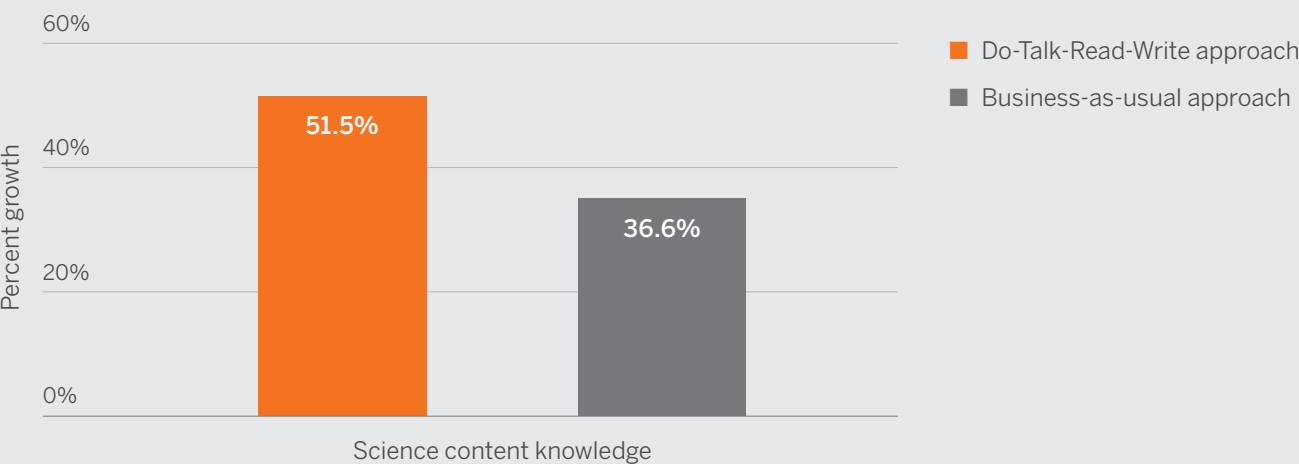
Grounded in research and proven effective

UC Berkeley’s Lawrence Hall of Science, the authors behind Amplify Science, developed the Do, Talk, Read, Write, Visualize approach, and gold-standard research shows that it works. Our own efficacy research is pretty exciting, too.

Instructional model

Amplify Science is rooted in the research-based, iterative Do, Talk, Read, Write, Visualize model of learning. Three third-party gold-standard studies provide evidence that students who learn through the Do, Talk, Read, Write approach (used in the *Seeds of Science/Roots of Reading*® program, which formed the foundation for the Amplify Science approach) saw the following benefits:

- Students using a Do, Talk, Read, Write approach significantly outperformed other students receiving their usual science instruction in the areas of science content knowledge and science vocabulary.
- English Language Learners (ELLs) significantly outperformed other ELLs in science content knowledge and science vocabulary.



Source: Cervetti, Barber, Dorph, Pearson, & Goldschmidt, 2012; Duesbury, Werblow, & Twyman, 2011; Wang & Herman, 2005

Program structure

Units per year

Grades K–2: **3**

Grades 3–5: **4**

Unit types

Although every Amplify Science unit provides a three-dimensional learning experience, each unit contains multiple science and engineering practices, but has one of the following specific practices as its focus.

Investigation

Investigation units focus on the process of strategically developing investigations and gathering data to answer questions. Students are first asked to consider questions about what happens in the natural world and why, and are then involved in designing and conducting investigations that produce data to help answer those questions.

Modeling

These Amplify Science units emphasize opportunities for students to engage in the practice of modeling. Students use physical models, investigate with computer models, and create their own diagrams to help them visualize what might be happening on the nanoscale.

Course structure

Each unit includes two dedicated assessment days.

Key: **A** Argumentation **E** Engineering Design
I Investigation **M** Modeling

Kindergarten



Needs of Plants and Animals

22 lessons

I



Pushes and Pulls

22 lessons

E



Sunlight and Weather

22 lessons

M

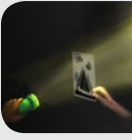
Grade 1



Animal and Plant Defenses

22 lessons

M



Light and Sound

22 lessons

E



Spinning Earth

22 lessons

I

Grade 2



Plant and Animal Relationships

22 lessons

I



Properties of Materials

22 lessons

E



Changing Landforms

22 lessons

M

Engineering design

Engineering design solves complex problems by applying science principles to the design of functional solutions, and iteratively testing those solutions to determine how well they meet pre-set criteria. All Amplify Science engineering design units are structured to make the development of such solutions the central focus.

Argumentation (grades 3–5)

These Amplify Science units emphasize opportunities for students to engage in the practice of argumentation. As students move up the K–5 grades, they focus on important aspects of argumentation in an intentional sequence.

Grade 3



Balancing Forces

22 lessons

M



Inheritance and Traits

22 lessons

I



Environments and Survival

22 lessons

E



Weather and Climate

22 lessons

A

Grade 4



Energy Conversions

22 lessons

E



Vision and Light

22 lessons

I



Earth's Features

22 lessons

A



Waves, Energy, and Information

22 lessons

M

Grade 5



Patterns of Earth and Sky

22 lessons

I



Modeling Matter

22 lessons

M



The Earth System

26 lessons

E



Ecosystem Restoration

22 lessons

A

Phenomena and student roles in grades K–5

In every Amplify Science unit, students take on the role of scientists or engineers—marine biologists, geologists, water resource engineers, and more—to solve a real-world problem. These engaging roles and phenomena bring science to life in your classroom.

Examples



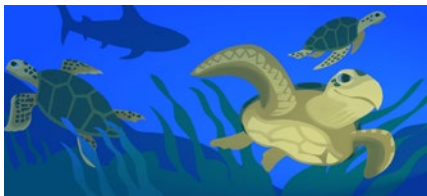
KINDERGARTEN

Pushes and Pulls

How can we create a pinball machine for our class?

Anchor phenomenon: Pinball machines allow people to control the direction and strength of forces on a ball.

Students take on the role of pinball machine engineers as they investigate the effects of forces on the motion of an object. They conduct tests in their own prototypes (models) of a pinball machine and use what they learn to contribute to the design of a class pinball machine. Over the course of the unit, students construct a foundational understanding of why things move in different ways.



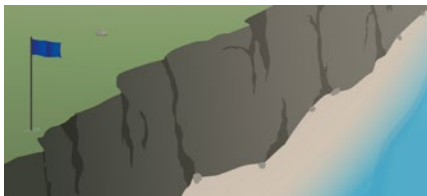
GRADE 1

Animal and Plant Defenses

How can a sea turtle survive in the ocean after an aquarium releases it?

Anchor phenomenon: Spruce the Sea Turtle lives in an aquarium and will soon be released back into the ocean, where she will survive despite ocean predators.

Students play the role of marine scientists. In their role, students apply their understanding of plant and animal defense structures to explain to aquarium visitors how a sea turtle and her offspring can defend themselves from ocean predators when they are released into the wild.



GRADE 2

Changing Landforms

Why is the edge of the ocean cliff closer to the flagpole than it used to be?

Anchor phenomenon: The cliff that Oceanside Recreation Center is situated on appears to be receding over time.

The director of the Oceanside Recreation Center gets a scare when a nearby cliff collapses overnight. Research reveals that the distance between the recreation center's flagpole and the edge of the cliff has changed over time. **Students play the role of geologists and work to figure out why the cliff has changed over time.** Based on what they learn about erosion, they advise on whether it is safe to keep the center open even though the cliff is changing.

GO ONLINE

To read about the anchor phenomena and student roles for every Amplify Science unit, visit amplify.com/sciencek5.



GRADE 3

Balancing Forces

How is it possible for a train to float?

Anchor phenomenon: The town of Faraday is getting a new train that floats above its tracks.

People in Faraday are excited to hear that a new train service will be built for their city, but concerned when they hear that it will be a floating train. **Students take on the role of scientists in Faraday to figure out how a floating train works in order to explain it to the city's residents.** They develop models of how the train rises, floats, and then falls back to the track, and then write an explanation of how the train works.



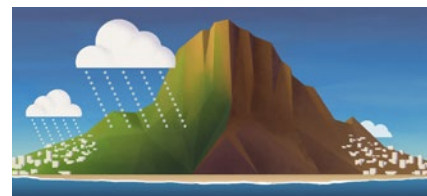
GRADE 4

Vision and Light

Why is an increase in light affecting the health of Tokay geckos in a Philippine rainforest?

Anchor phenomenon: The population of Tokay geckos in a rainforest in the Philippines has decreased since the installation of new highway lights.

As conservation biologists, students work to figure out why a population of Tokay geckos has decreased since the installation of new highway lights in the rainforest. Students use their understanding of vision, light, and information processing to figure out why an increase in light in the geckos' habitat is affecting the population.



GRADE 5

The Earth System

Why is East Ferris experiencing a water shortage and what can the city do about it?

Anchor phenomenon: East Ferris, a city on one side of the fictional Ferris Island, is experiencing a water shortage, while West Ferris is not.

The cities of East Ferris and West Ferris are located on different sides of a mountain on the fictional Ferris Island. East Ferris is having a water shortage while West Ferris is not. **As water resource engineers, students learn about the Earth system to help figure out what is causing the water shortage problem and design possible solutions, including freshwater collection systems and proposals for using chemical reactions to treat wastewater.**

Approach to assessment

The Amplify Science assessment system is grounded in the principle that students benefit from regular and varied opportunities to demonstrate understanding through performance.

Each unit includes a range of formative assessments embedded in instruction with the goal of providing regular, actionable information to the teacher with minimal impact on instructional time.

The variety of assessment options for Amplify Science K–5 include:

F Formative **S** Summative

Formative

Pre-Unit Assessment

These assessments make use of discussion, modeling, and written explanations to gauge student knowledge prior to starting a unit.

Formative

On-the-Fly Assessments (OtFAs)

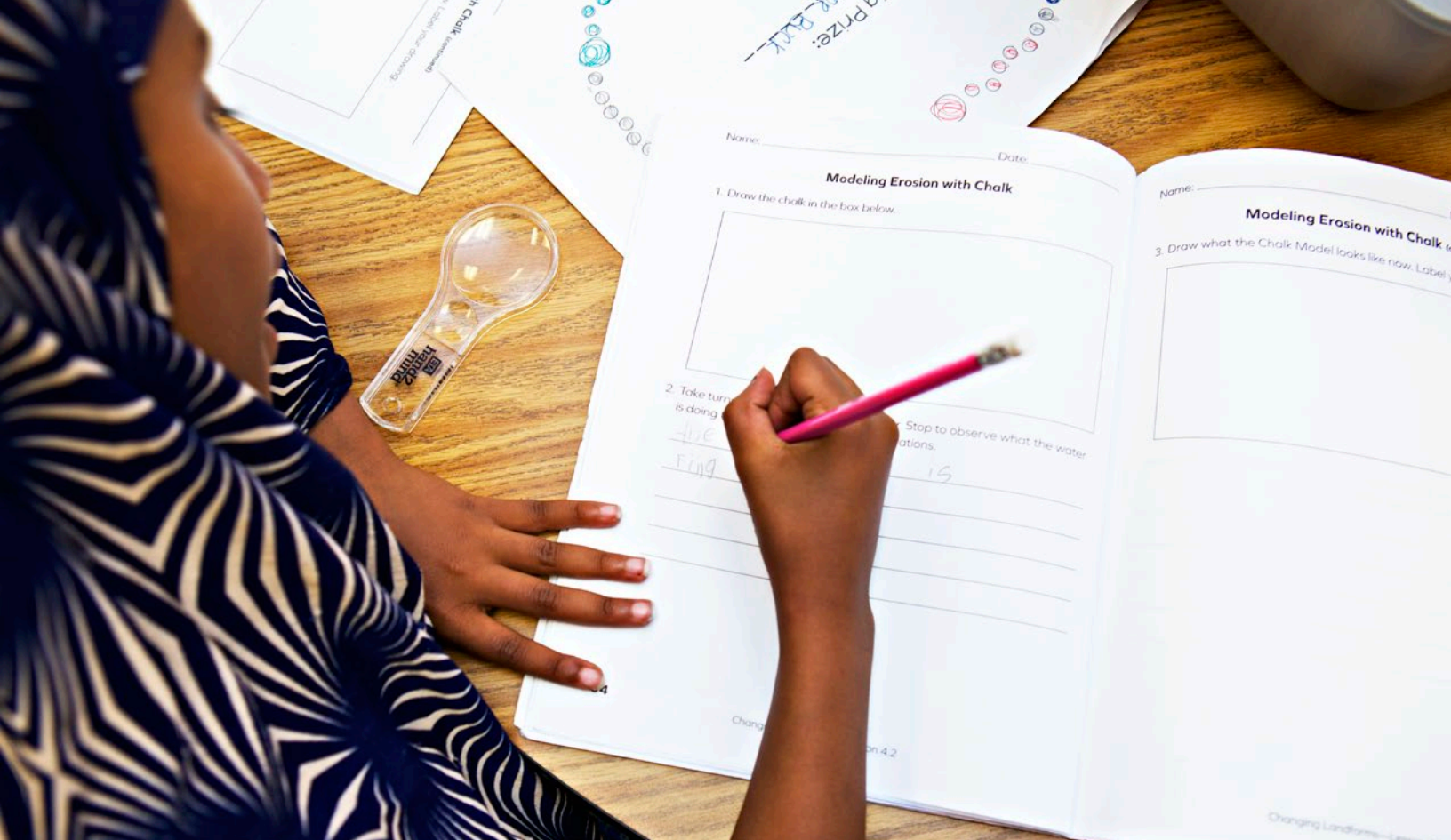
Multidimensional assessments integrated regularly throughout the lessons. OtFA opportunities were designed to help a teacher make sense of student activity during a learning experience and to provide evidence of how a student is coming to understand core concepts and developing dexterity with SEPs and CCCs.

Self-Assessments

Once per chapter, students are given a brief opportunity to reflect on their own learning, ask questions, and reveal ongoing wonderings about unit content. Students respond to a consistent set of prompts each time, ensuring that their own progress is visible to them.

Critical Juncture Assessments

Each chapter includes an integrated multidimensional performance task that supports students’ consolidation of the ideas encountered in the chapter and provides insight into students’ developing understanding. Examples include writing scientific explanations, engaging in argumentation, developing and using models, and designing engineering solutions.



Summative

End-of-Unit Assessment

Assessments toward the end of each unit feature a combination of targeted discussions, student-generated models, and written explanations or arguments to enable students to demonstrate understanding and growth at the conclusion of a unit.



NGSS BENCHMARK ASSESSMENTS

Developed by Amplify, the Next Generation Science Standards (NGSS) Benchmark Assessments give you insight into how your students are progressing toward mastery of the three dimensions and performance expectations of the NGSS ahead of high-stakes end-of-year assessments. They are given 3–4 times per year, depending on the grade level, and are delivered after specific units in the recommended Amplify Science scope and sequence.





Engaging materials

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Hands-on investigations in grades K–5

Hands-on learning is an essential part of Amplify Science, and is integrated into every unit. Students actively participate in science, playing the roles of scientists and engineers as they gather evidence, think critically, solve problems, and develop and defend claims about the world around them. Every unit includes hands-on investigations that are critical to achieving the unit’s learning goals.

Examples

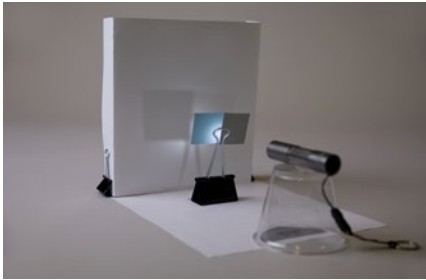


KINDERGARTEN

Pushes and Pulls

Showcasing the Box Models (Lesson 5.3)

In Lesson 5.2 of Pushes and Pulls, students synthesize what they have figured out about force and motion to create a culminating design for their pinball machine models. Students incorporate a launcher, flippers, and bumpers into their model to help their pinball reach a target. Students then test their models to observe whether or not their solutions work as expected, and then make any additional modifications as necessary.

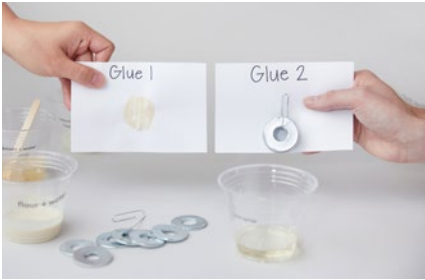


GRADE 1

Light and Sound

Investigating Materials That Do Not Block (Lesson 3.1)

By Lesson 3.1 of Light and Sound, students have figured out that not all materials block light to create a dark area on a surface. Partners use their Investigation Kits to test non-blocking materials (clear plastic, tinted plastic, and wax paper) in comparison to cardboard, a known blocking material. Students use their observations of these materials comparisons to discuss what may cause variation in the brightness of the areas created on a surface.



GRADE 2

Properties of Materials

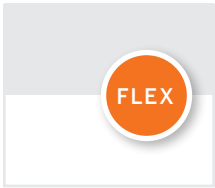
Making Our Second Glue and Setting Up Tests (Lesson 3.5)

In Lesson 3.5 of Properties of Materials, students apply the evidence that they have collected about the properties of glue ingredients to create a recipe for a glue that meets a series of design goals. Students use available ingredients to create their unique glue and then set up a fair test with partners that will allow them to compare the properties of their glues.



GO ONLINE

For a complete materials list and to see more example activities, visit amplify.com/sciencek5.



Hands-on Flextions

Hands-on Flextions are additional, optional investigations that are included at logical points in the learning progression and give students an opportunity to dig deeper if time permits. These activities offer teachers flexibility to choose to dedicate more time to hands-on learning.

Materials referenced in Hands-on Flextion activities will either be included in the unit kit or are easily sourced. Supporting resources such as student worksheets will be included as downloadable PDF files.

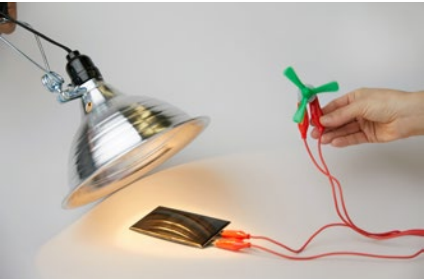


GRADE 3

Inheritance and Traits

Exploring Inheritance (Lesson 2.4)

In Lesson 2.4 of Inheritance and Traits, students investigate how traits are passed down from parents to offspring by building clay creature offspring. Students work in pairs to make clay creature offspring with specific traits based on instructions that were randomly inherited from two parent creatures. In the discussion following the activity, students compare creatures and observe that, although the offspring inherited instructions from the same parents, there is variation in traits among siblings.



GRADE 4

Energy Conversions

Designing Wind Turbines (Lesson 3.4)

In Lesson 3.4 students are introduced to their first hands-on design challenge: to design and build a wind turbine. Students receive two proposed solutions to the blackout problem in Ergstown, both of which are intended to bring more energy to the electrical system: installing solar panels or installing wind turbines. In order to make an informed choice between the two proposed solutions, students are given a design challenge: to build a wind turbine that meets certain design criteria. Students then engage in the design cycle as they explore the available materials and plan, make, and test their wind turbine designs.

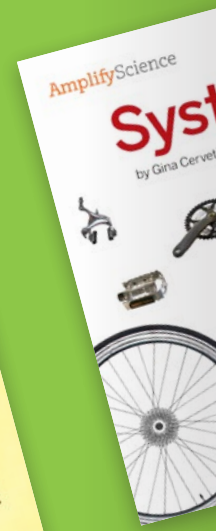
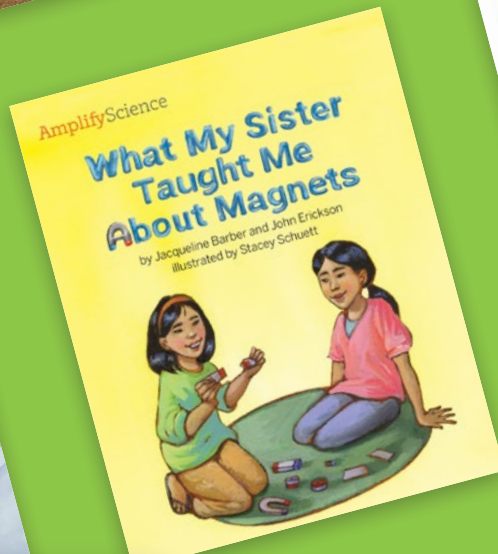
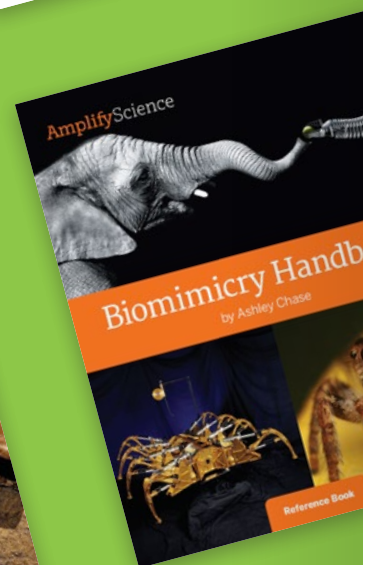
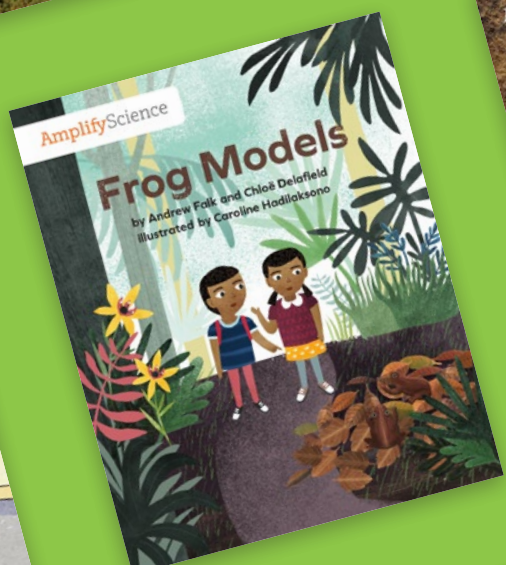
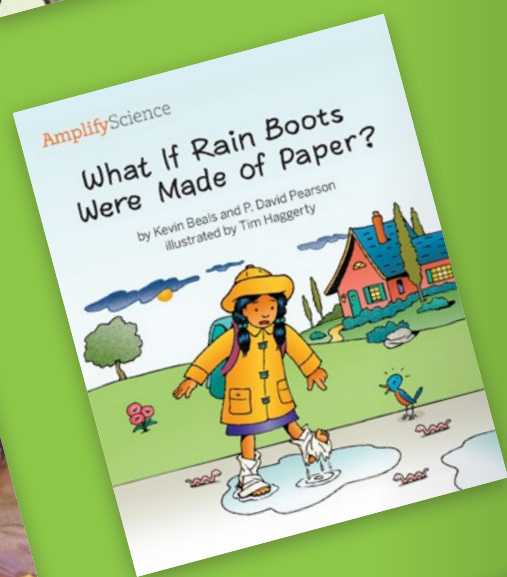
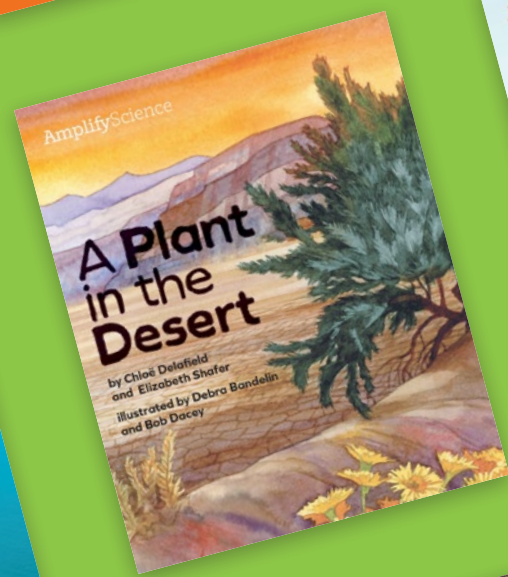
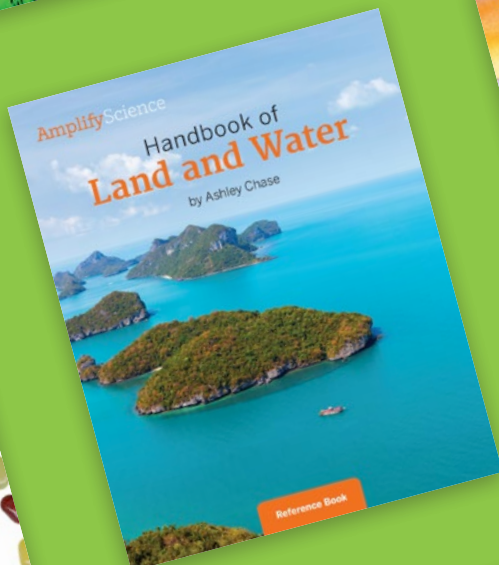
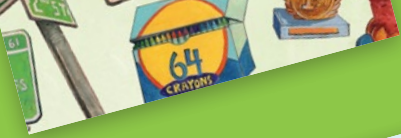
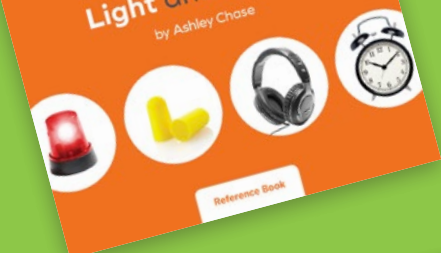
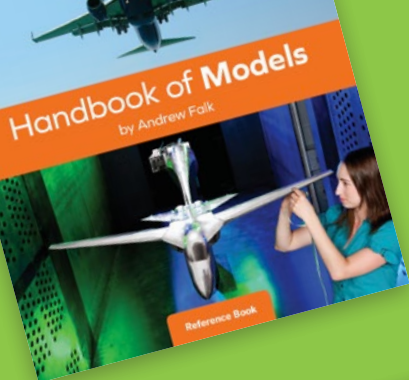


GRADE 5

The Earth System

Observing Substances and Mixing Substances (Lesson 5.1)

In Lesson 5.1 of The Earth System, students investigate how new substances form. Students observe a chemical reaction by mixing calcium chloride, baking soda, and phenol red solution. They discuss and record their observations of the substances before, during, and after the reaction.



GO ONLINE

Preview all Student Books in grades K–5
at amplify.com/sciencek5.

Student Books

About the books

Each unit of Amplify Science K–5 includes five unique Student Books written by the Lawrence Hall of Science specifically for the program. The five books in each unit include one book for approximately every five days of instruction and one reference book that students draw upon throughout the unit.

These content-rich nonfiction and informational texts provide opportunities for students to search for evidence relevant to their firsthand investigations, see science practices and dispositions modeled, extend their science knowledge, provide real world connections as they master reading-to-learn and close reading skills, and construct evidence-based arguments.

Instructional approach

Beginning and young readers have unique developmental needs, and science instruction should support these students in reading more independently as they progress through sections of content, the school year, and each grade.

One way Amplify Science meets these needs is by strategically deploying different modes of reading throughout each unit: Read-Aloud, Shared Reading, and Partner Reading.



Read-Aloud

In the Read-Aloud mode, the teacher reads the book while students listen. During a Read-Aloud, the teacher models fluent and expressive reading, demonstrates strategic reading, thinks aloud about the content of the book, introduces new vocabulary, and facilitates students' comprehension as the class gathers information to figure out a science idea.



Shared Reading

In the Shared Reading mode, the teacher and students interact with the book together. Shared Reading provides additional opportunities for students to observe the teacher as an expert reader, to actively join in the discussion about the book, and to practice using a focal comprehension strategy.



Partner Reading

In Partner Reading mode, two students work together to read or gather information from a book. Partner Reading provides opportunities for each student in a pair to be the reader and the supporter while reading a text.

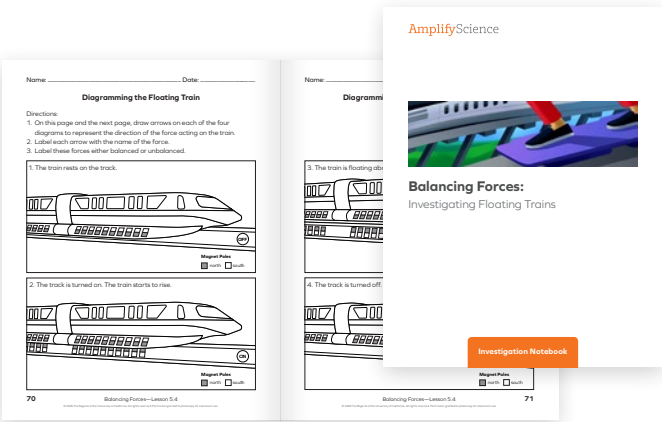


SPANISH LANGUAGE SUPPORT

All Student Books are also available in Spanish.

Student Investigation Notebooks

Every unit in Amplify Science has a Student Investigation Notebook, where students record data and observations, make drawings, and complete writing tasks. Scaffolding supports for reading and writing activities are also included in each notebook.



In grades K–5, one copy of the Student Investigation Notebook is included in each unit’s materials kit for use as a blackline master.

The Student Investigation Notebook for each unit is also available as a downloadable PDF on the Unit Guide page of the digital Teacher’s Guide.

Printable Resources

 **Coherence Flowcharts**

 **Copymaster Compilation**

 **Investigation Notebook**

 **Multi-Language Glossary**

 SPANISH LANGUAGE SUPPORT

All Student Investigation Notebooks are also available in Spanish.

Light and Sound:
Puppet-Theater Engineers

AmplifyScience



Ecosystem Restoration:
Matter and Energy in a Rain Forest

AmplifyScience



Balancing Forces:
Investigating Floating Trains

AmplifyScience



Animal and Plant Defenses:
Spikes, Shells, and Camouflage

AmplifyScience



Distance and Traits:
Changes in Wolves

AmplifyScience



Patterns of Earth and Sky:
Analyzing Stars on Ancient Artifacts

AmplifyScience



Vision and Light:
Investigating Animal Eyes

AmplifyScience

Modeling Matter:
The Chemistry of Food

AmplifyScience



Properties of Materials:
Designing Glue

AmplifyScience

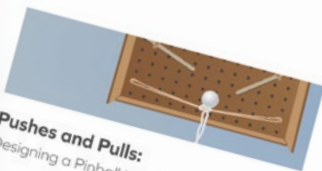


The Earth System:
Investigating Water Shortages

AmplifyScience

Weather:
Weather Reserve

AmplifyScience



Pushes and Pulls:
Designing a Pinball Machine



GO ONLINE

To view full Student Investigation Notebooks for elementary school units, begin your review at amplify.com/sciencek5.

Digital resources

Students have access to a variety of digital tools to enrich their learning throughout the Amplify Science K–5 program.

Grades K–1

In kindergarten and grade 1, students observe various types of media (videos, images, etc.) through teacher projections. In these grade levels, however, students are not expected to access their own digital experiences.



Grades 2–3

In grades 2 and 3, some student-facing technology is available, with four to five lessons per unit that have activities where students can use science practice tools to aid in the modeling, graphing, and sorting of information related to the unit's central problem. (A unit has 22 lessons total.)



Grades 4–5

Students in grades 4 and 5 use digital tools and simulations more frequently, with 30-40 percent of lessons including opportunities to use a digital tool.



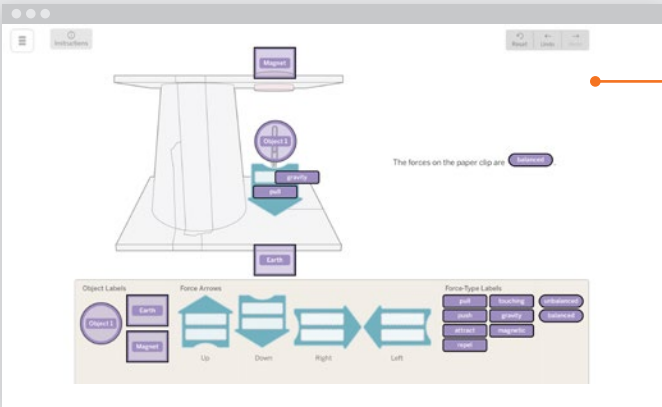
Videos

Videos are incorporated into Amplify Science units across grades K–5. Whenever a video is present, the teacher projects the video to the students from their own device. Students are never prompted to access videos themselves in Amplify Science grades K–5. If a teacher does not have internet access in the classroom, they can download videos before class.



Practice Tools

A collection of unit-specific digital apps, Practice Tools include simple drag-and-drop activities or easy-to-use data-entry tools to aid students with sorting, modeling, or visualizing information. Practice Tools are included in each unit in grades 2–5, appearing in approximately three to five lessons per unit.



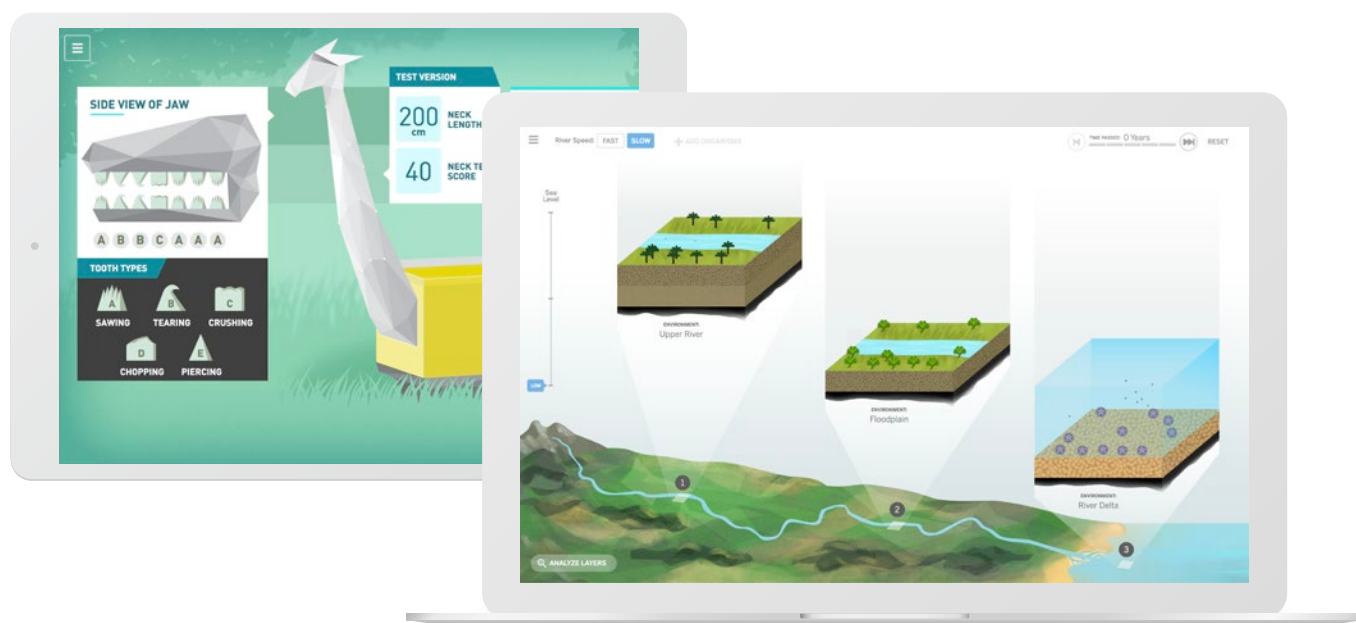
Modeling Tool



Data Tool

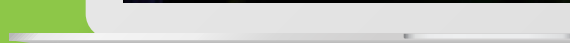
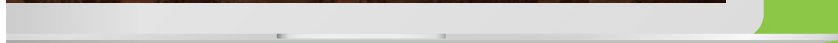
Digital simulations

One unit in grade 3 and all units in grades 4 and 5 include the opportunity to use a unique digital simulation (“Sim”). Sims allow students to explore scientific concepts that might otherwise be invisible or impossible to see with the naked eye.



Much like real scientists do, students will use these computer simulations to gain insight into processes that occur on the microscopic scale, or to speed up processes that might otherwise take thousands or millions of years to observe.

Simulations are just one of several components teachers will use to teach a given scientific concept. The same concepts will be explored through hands-on activities, Student Books written for the unit, classroom discussions, and more. Each of these tools and techniques gives every student multiple opportunities and modalities through which to explore and ultimately figure out the scientific concept. Sims appear in five to nine lessons per unit in the grade 4 and grade 5 units.



Teacher's Guides

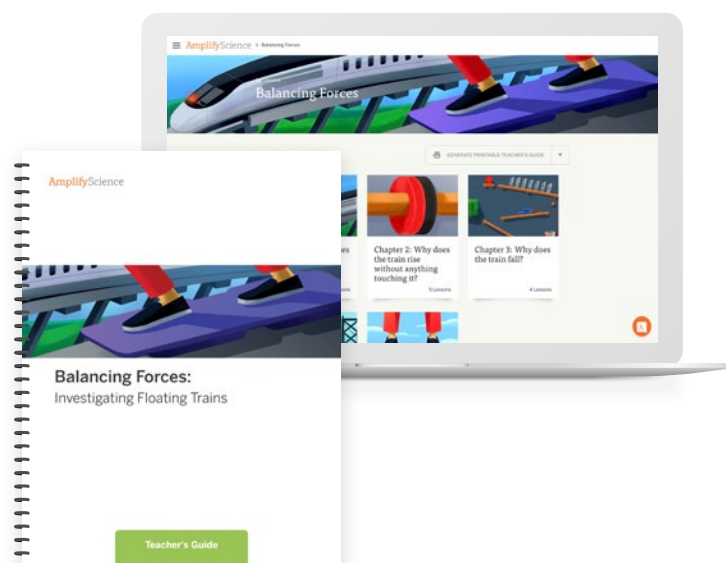
Every unit of Amplify Science includes a comprehensive Teacher's Guide containing lesson plans, differentiation strategies, and other instructional supports and resources at the unit, lesson, and individual activity levels.

Plan for instruction

Teachers can access their lesson plans through the print or digital Teacher's Guides. Both formats include the same unit-level overview and preparation information, as well as step-by-step instructions for every activity in every lesson.

The Teacher's Guide contains step-by-step teaching instructions, which include:

- Teacher Supports, which note background information, pedagogical rationale, or instructional suggestions for the teacher.
- Possible Responses, which provide information about how to evaluate student work. These are found at the end of the Activity in a shaded box.
- On-the-Fly Assessments, which offer guidance for using formative assessment opportunities.



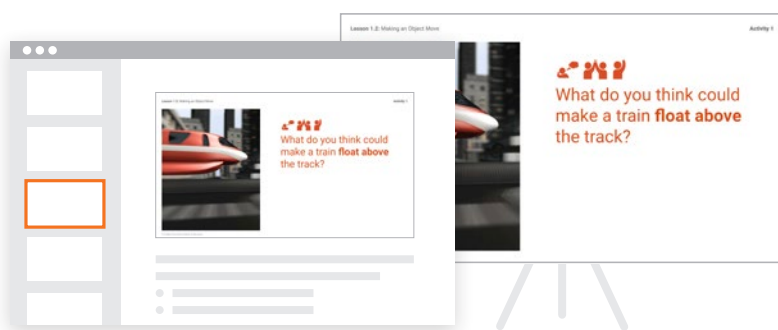
SPANISH LANGUAGE SUPPORT

A Spanish add-on license gives teachers access to lesson projections, PDFs of print materials, and recommended in-class “teacher talk” moments in Spanish.

GO ONLINE

Log into the digital Teacher's Guide and explore digital tools in Amplify Science at amplify.com/sciencek5.

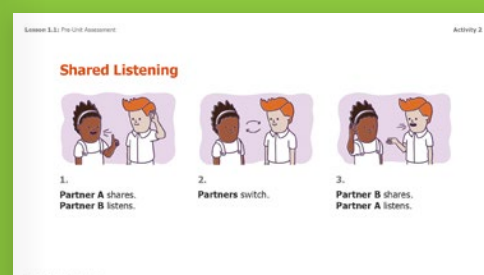
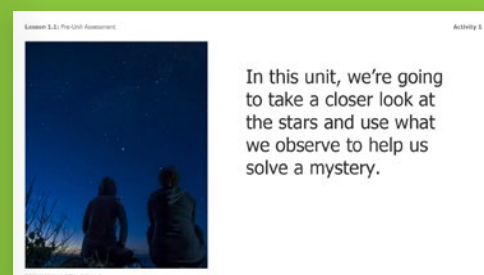
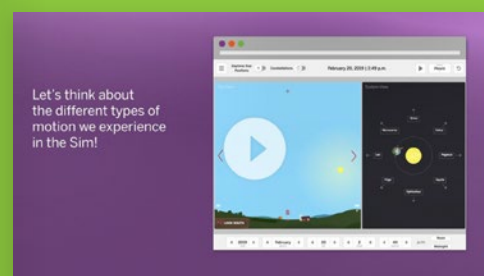
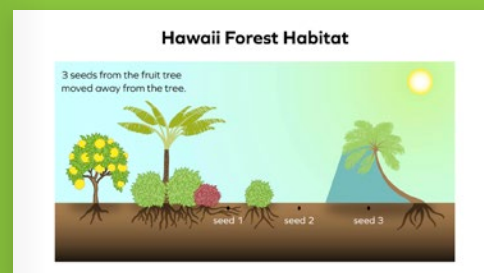
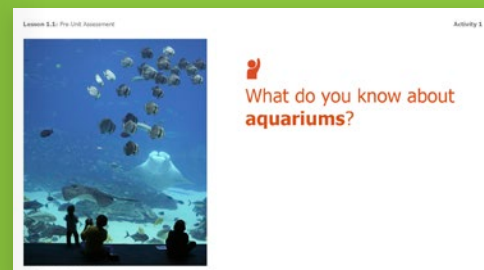
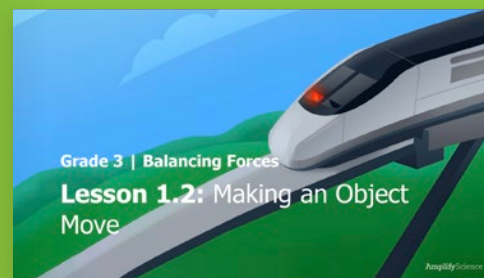
Deliver instruction

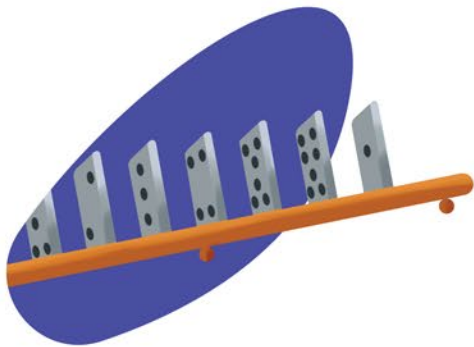


Classroom Slides

To make planning and delivering instruction faster and easier, Amplify has developed Classroom Slides for all K–5 lessons. Each lesson comes with a downloadable and editable PowerPoint file to help guide teachers and their students through the lesson with clearly-sequenced, engaging, and easy-to-follow images, videos, questions, and instructions.

Classroom Slides allow teachers to easily customize their lessons and streamline the in-class presentation experience. Slides take key lesson content—including student-facing questions, teacher prompts, activity transitions, and visuals—and put it in a logical sequence. At any time, teachers can feel free to change the wording, paste in a new visual, or link to their favorite YouTube video.





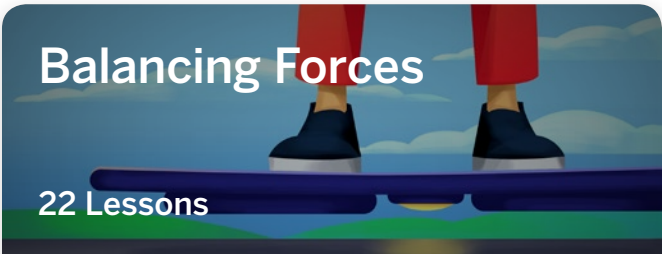


In your classroom

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Grade 3: Year at a glance

Grade 3 in Amplify Science contains four units, each containing 22 total lessons: 20 60-minute lessons and two dedicated assessment days.



Balancing Forces

22 Lessons

20 60-minute lessons

2 dedicated assessment days

Modeling focus

In *Balancing Forces: Investigating Floating Trains*, students investigate touching and non-touching forces, and then work to explain balanced and unbalanced forces.

Student role and phenomena

Students take on the role of consultants to the mayor of the fictitious city of Faraday and are challenged to figure out how the city’s new “floating train” rises, floats about the track, and then later falls back to the track.

Insights

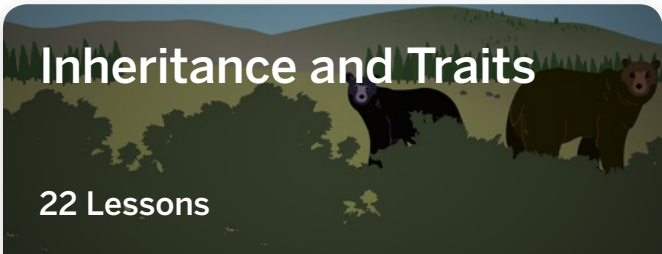
Balancing Forces provides an opportunity for students to gain experience constructing and revising many different types of models, including physical models such as a floating paperclip device, digital models, and hand-drawn models of the magnetic levitation train.

Focal NGSS Performance Expectations:

3-PS2-1 • 3-PS2-2 • 3-PS2-3 • 3-PS2-4

Focal Disciplinary Core Ideas:

PS2.A • PS2.B



Inheritance and Traits

22 Lessons

20 60-minute lessons

2 dedicated assessment days

Investigation focus

In the *Inheritance and Traits: Variation in Wolves* unit, students dive deep into exploring patterns in the traits of organisms to answer the question of how those traits come to be.

Student role and phenomena

Students assume the role of wildlife biologists helping a class of students near the fictional Graystone National Park to solve the mystery of Wolf 44—a wolf they have observed to be different from the rest of its pack—which serves as the anchor phenomenon for the unit.

Insights

In *Inheritance and Traits*, students investigate several questions, such as “Why isn’t Wolf 33 like the Bison Valley Pack in hunting style and size?” and “How can scientists investigate questions about traits?” to construct an accurate understanding of the influences that inheritance and environment play in determining organisms’ traits.

Focal NGSS Performance Expectations:

3-LS1-1 • 3-LS2-1 • 3-LS3-1 • 3-LS3-2

Focal Disciplinary Core Ideas:

LS1.B • LS2.D • LS3.A • LS3.B

Environments and Survival

22 Lessons

20 60-minute lessons

2 dedicated assessment days

Engineering design focus

In the *Environments and Survival: Snails, Robots, and Biomimicry* unit, students work to explain why the snails with yellow shells in the population aren't surviving as well as the snails with banded shells.

Student role and phenomena

Students assume the role of biomimicry engineers studying a population of grove snails to understand how the snails' traits influence their survival in a changing environment.

Insights

Environments and Survival provides an opportunity for students to investigate factors affecting organisms' survival. Students write scientific explanations about their findings to communicate ideas to a fictional engineering firm to help the firm design a robot that aims to mitigate the effect of an environmental change.

Focal NGSS Performance Expectations:

3-LS4-1 • 3-LS4-2 • 3-LS4-3 • 3-LS4-4
3-5 ETS1-1 • 3-5 ETS1-2 • 3-5 ETS1-3

Focal Disciplinary Core Ideas:

LS2.C • LS4.A • LS4.B • LS4.C
LS4.D • ETS1.A • ETS1.B • ETS1.C

Weather and Climate

22 Lessons

20 60-minute lessons

2 dedicated assessment days

Argumentation focus

In the *Weather and Climate: Establishing an Orangutan Reserve* unit, students analyze the weather on three fictional islands in order to determine which has weather most like the locations where orangutans live and recommend one island for a new reserve.

Student role and phenomena

In the role of meteorologists working for the fictitious Wildlife Protection Organization (WPO), students investigate weather patterns as they solve the problem of where to establish an orangutan reserve.

Insights

Weather and Climate provides an opportunity for students to analyze weather data and identify weather patterns over different timescales. Students construct an understanding of this difference and why it is significant and then apply that understanding to constructing scientific arguments based on their best evidence for the location of a new orangutan preserve.

Focal NGSS Performance Expectations:

3-ESS2-1 • 3-ESS2-2 • 3-ESS3-1

Focal Disciplinary Core Ideas:

ESS2.D • ESS3.B

Deep dive: Balancing Forces

Take a closer look at the lessons and activities in the “Balancing Forces” unit.

CHAPTER 1 – DAY 1 Lesson 1.1 Pre-Unit Assessment 	DAY 2 Lesson 1.2 Making an Object Move 	DAY 3 Lesson 1.3 Forces All Around 
DAY 6 Lesson 2.2 What Objects Do Magnetic Forces Act On? 	DAY 7 Lesson 2.3 Investigating Ways Magnetic Force Moves Objects 	DAY 8 Lesson 2.4 What My Sister Taught Me About Magnets 
DAY 11 Lesson 3.2 Reading About Gravity 	DAY 12 Lesson 3.3 Observing Forces in Chain Reactions 	DAY 13 Lesson 3.4 Modeling and Explaining the Falling Train 
DAY 16 Lesson 4.3 Explaining a Bridge 	DAY 17 Lesson 4.4 Modeling and Explaining Balanced Forces 	CHAPTER 5 – DAY 18 Lesson 5.1 Investigating Unbalanced Forces 
DAY 21 Lesson 5.4 Modeling the Train 	DAY 22 Lesson 5.5 End-of-Unit Assessment: Students' Explanations 	



DAY 4

Lesson 1.4
Explaining Forces and the Train



CHAPTER 2 – DAY 5

Lesson 2.1
Discovering Non-Touching Forces



Lesson includes a reading activity with Student Books

DAY 9

Lesson 2.5
Explaining Magnetic Force and the Train



CHAPTER 3 – DAY 10

Lesson 3.1
Observing Evidence of Gravity



Lesson includes a hands-on investigation

CHAPTER 4 – DAY 14

Lesson 4.1
One Object, Two Forces



DAY 15

Lesson 4.2
Investigating Balanced Forces



Lesson includes scientific writing activity

DAY 19

Lesson 5.2
Hoverboard



DAY 20

Lesson 5.3
Electromagnets and Predicting Patterns



Lesson includes use of digital modeling tools



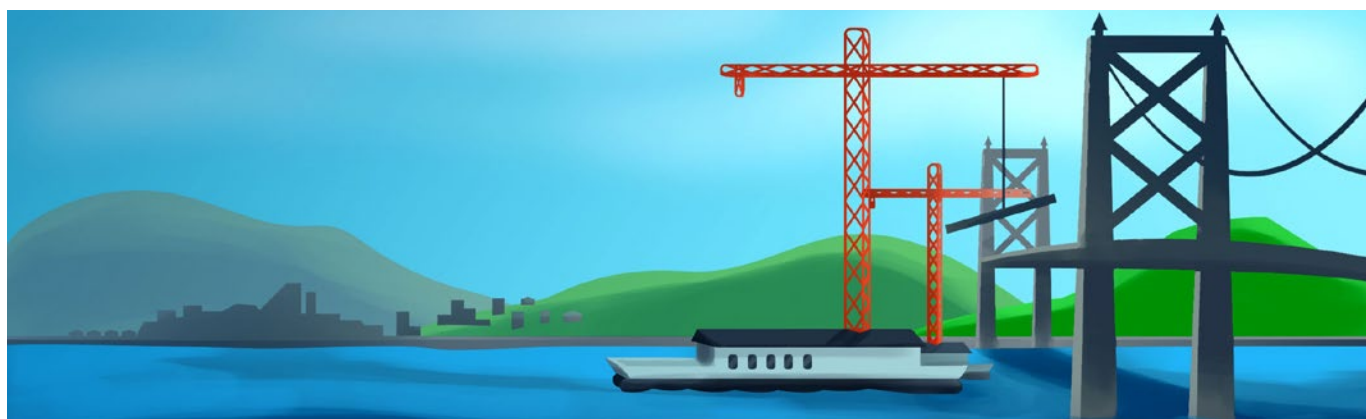
Dedicated assessment day



Lesson includes a discussion activity

Unit storyline: Balancing Forces

On the following pages, you'll find teacher and student sample pages and highlights of digital features for the "Balancing Forces" unit. Follow along with the print Teacher's Guide included in your sample or online with the digital Teacher's Guide.



In the unit, students learn that scientists and engineers have figured out a way to build a train that actually floats on air as it goes cruising down the track at high speeds. Using similar principles, engineers have created a hoverboard—a device like a skateboard that floats above a track rather than rolling along the ground.

Students work to investigate and then explain how these inventions seem to defy logic. Over the course of the unit, through firsthand experiences, discussion, reading and writing informational text, students will come to understand how forces can cause stability or change in an object's motion.

They will discover how magnetic force can be used to counterbalance the force of gravity. They will create physical models, diagram models, and write and present scientific explanations detailing how the maglev (magnetic levitation) train appears to defy gravity by floating.

The new problem students work through at the end of the unit is how the new Bay Bridge is safe for cars and trucks to cross (Chapter 4, lesson 3).

Sample unit walkthrough

Walkthrough progress

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Teacher sample page: Unit Overview

Unit Overview



Balancing Forces
Planning for the Unit

Unit Overview

What's in This Unit?

Scientists and engineers have figured out a way to build a train that actually floats on air as it goes cruising down the track at high speeds. Using similar principles, engineers have created a hoverboard—a device like a skateboard that floats above a track rather than rolling along the ground. In the *Balancing Forces* unit, students work to investigate and then explain how these inventions seem to defy logic. Over the course of the unit, through firsthand experiences, discourse, and reading and writing informational text, students will come to understand how forces can cause stability or change in an object's motion. They will discover how magnetic force can be used to counterbalance the force of gravity. They will create physical models, diagram models, and write, and present scientific explanations detailing how the maglev (magnetic levitation) train appears to defy gravity by floating.

Why?

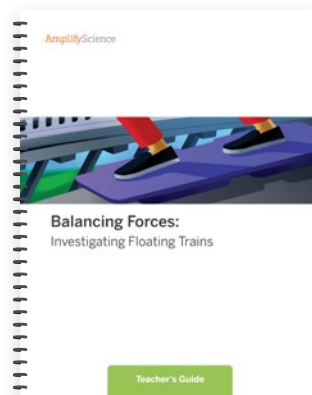
In the *Balancing Forces* unit, students explore forces that are acting on and around them every day, often unseen and misunderstood. (Even adults can find themselves perplexed or battling long-held misconceptions if asked to explain unseen forces, such as gravity and magnetic force!) Since these concepts are abstract and global in nature, it requires a great deal of firsthand exploration and sense-making to help students ground their understanding and integrate their new knowledge. Spending an entire 20-lesson unit (plus a pre-unit-assessment lesson and an end-of-unit-assessment lesson) to understand how a floating train works provides students with the necessary experiences, processing time, and extra supports to truly understand a phenomenon that requires a grasp of an array of foundational concepts in the area of force and motion. Our approach in this unit provides just this type of necessary support. Along with planning and conducting firsthand investigations, students read informational text, find patterns in data, and show their ideas with models—both physical models and diagrams. They have the opportunity for plenty of student-to-student discussions as they grapple with coming to understand some challenging physical science concepts.

How?

The *Balancing Forces* unit begins as students are introduced to a fictional scenario—the citizens of the city of Faraday are excited to hear that a new train service will be built for their city. However, they are concerned when they hear that the train will be a floating train. Students are challenged to figure out how the floating train works in order to explain it to the citizens of Faraday. The problem of explaining how the floating train works is broken down into smaller problems.

In Chapter 1, students work to answer the question *Why does the train rise?* They begin by investigating touching forces through hands-on investigations and by reading about forces in everyday life. They find patterns in data from both sources and discover that when an object starts or stops moving, this change in motion is evidence of a force. They also find that forces act between two objects. They apply their understanding by making a chain reaction and identifying the forces involved, and by writing a short explanation of why the train rises.

In Chapter 2, students work to answer the question *Why does the train rise without anything touching it?* They plan and conduct investigations that lead them to discover that a non-touching force can act between magnets and some other objects. Through more investigations and by reading about a fictional girl's investigations, students uncover patterns in how magnetic forces move objects—magnets attract some metal objects, and can attract or repel other magnets. Students apply their understanding by making a physical model of the train rising and by writing a new scientific explanation of why it rises.

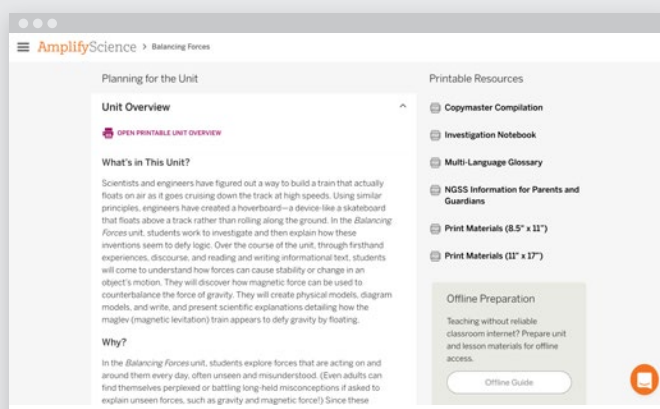


Find the Unit Overview in the exemplar Teacher's Guide included in your sample.

The Unit Overview provides you with an outline of the unit, including what the unit is about, why the unit was written this particular way, and how students will experience the unit. The Unit Overview is one of the most important documents for teachers to review before teaching a unit.

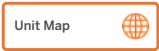


To access the Unit Overview in the digital Teacher's Guide, expand the "Unit Overview" section of the Unit Guide when you first click into a unit. The Unit Overview is also downloadable as a PDF.



Walkthrough progress **PLAN** TEACH ASSESS

Teacher sample page: **Unit Map**



Balancing Forces
Planning for the Unit

Unit Map

How is it possible for a train to float?

Students are challenged to figure out how a floating train works in order to explain it to the citizens of Faraday. People in Faraday are excited to hear that a new train service will be built for their city, but concerned when they hear that it will be a floating train. Students develop models of how the train rises, floats, and then falls back to the track, and then write an explanation of how the train works.

Chapter 1: Why does the train rise?

Students figure out: A train is a big object. Objects can start moving when they are pushed or pulled on by a second object. There must be some force acting between the train and another object to make the train rise.

How they figure it out: Students plan and carry out hands-on investigations and explore text as they seek explanations for why the train rises. They discover patterns in what can make an object change motion by starting to move or stopping. They write their first scientific explanation.

Chapter 2: Why does the train rise without anything touching it?

Students figure out: When the train starts moving as it rises off the track, it does so because of a non-touching force: magnetic force. The train rises because a repelling force acts between magnets on the tracks and magnets on the train.

How they figure it out: Students gather evidence to explain how the train could rise without anything touching it. They plan and conduct investigations that help them discover that magnets can exert forces at a distance. To find out how magnetic force can make objects move, they conduct more investigations, analyze data to find patterns, and gather evidence by reading. As they figure out what they think causes the train to rise, students write new explanations and create both physical models and diagram models that represent the magnetic forces at work.

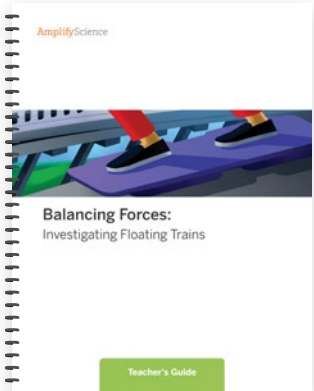
Chapter 3: Why does the train fall?

Students figure out: When the train falls, it does so because a force is acting on it. Since a second object is not pushing or pulling the train, there must be a non-touching force at work. The train falls because of the force of gravity. We know that forces always act between two objects. The force of gravity is acting between the train and Earth. Earth attracts the train, and the train moves toward it.

How they figure it out: Students figure out what they think causes the train to fall. They make observations and pose questions about gravity and gather evidence from a reference book. They design chain reactions involving touching forces and non-touching forces: magnetic force and gravity. They analyze patterns in data from the chain reaction and make diagrams modeling the forces involved. Students apply what they learned about gravity to write scientific explanations for why the train falls.

Chapter 4: Why does the train float?

Students figure out: More than one force can be exerted on the train at a time. The force of gravity is pulling the train toward Earth, and magnetic force is pushing the train up away from the tracks. Those forces work in opposite directions so when the forces are balanced, the train floats and stays in the air.

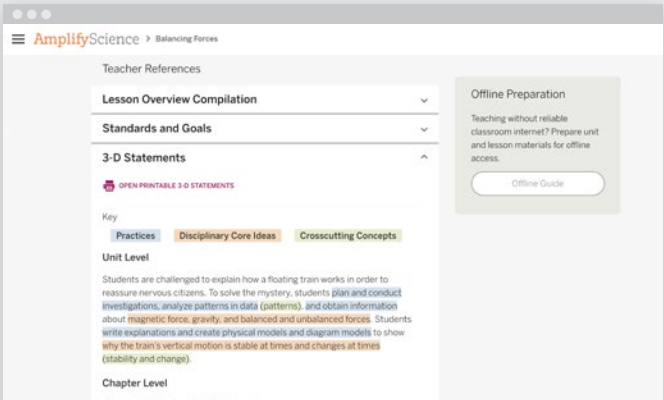


Find the Unit Map in the exemplar Teacher's Guide included in your sample.

The Unit Map is a summary that shows teachers how chapters within the unit build upon each other, what questions students will investigate, and what evidence sources they will use to figure those questions out.



To access Unit Map in the digital Teacher's Guide, expand the "Unit Map" section of the Unit Guide when you first click into a unit. The Unit Map is also downloadable as a PDF.



Walkthrough progress

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Teacher sample page: Instructional Guide

Lesson 1.3
Activity 2



Balancing Forces
Lesson Guides



Forces All Around

Teacher models searching for evidence of forces by reading aloud the first few pages of the book and showing how to record that evidence.



Instructional Guide

1. Demonstrate reading with a purpose and marking the text with a sticky note. Think aloud as you model how to read with a purpose.

- Explain what reading with a purpose is.

Reading with a purpose means having an idea in mind that you want to read and find out about.

- Hold up a copy of the *Forces All Around* book. Model the process of beginning to read by noticing the pictures on the cover. Think-aloud about how you will recognize evidence of a force.

Now that I've set a purpose before reading, I know what I want to focus on and look for as I read this book. As I read, I'm looking for evidence of forces, such as something starting to move. Since there are illustrations in the book, we aren't going to observe anything actually moving like we did in our investigation, but we can probably tell from the pictures and the words what is moving.

- Read aloud the first page of the book and model the process of finding out about a force and how it makes something move, and marking the page with a sticky note.

In the picture, I can see there's a ball that bounced off the desk and onto the floor. Something made the ball start moving so it bounced off the desk, so there must have been a force.

- Continue reading aloud the next two pages. Mark one more example of evidence of forces on pages 4–5.

On page 5, it says, "When the skateboard started moving, that was evidence of a force." I'm going to mark that example, too.



Classroom Slides, Lesson 1.3

Find the Instructional Guide for Lesson 1.3 in the exemplar Teacher's Guide included in your sample.

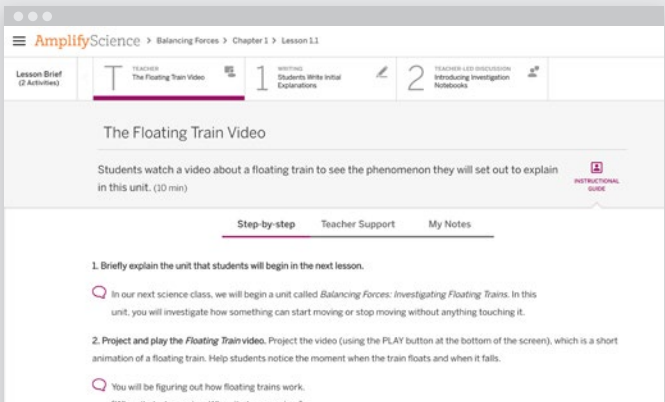
The Instructional Guide contains step-by-step instructions for teachers, including teacher talk and discussion prompts.

In Lesson 1.3 of *Balancing Forces*, teachers introduce *Forces All Around*, which students will read with the purpose of finding evidence of forces.



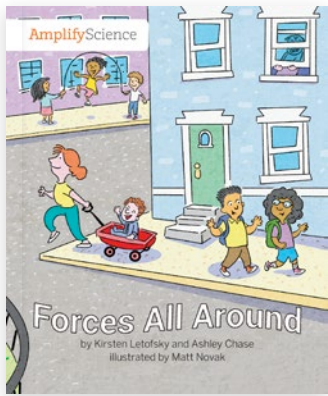
GO ONLINE

To access the Instructional Guide in the digital Teacher's Guide, click on any activity within a Lesson.



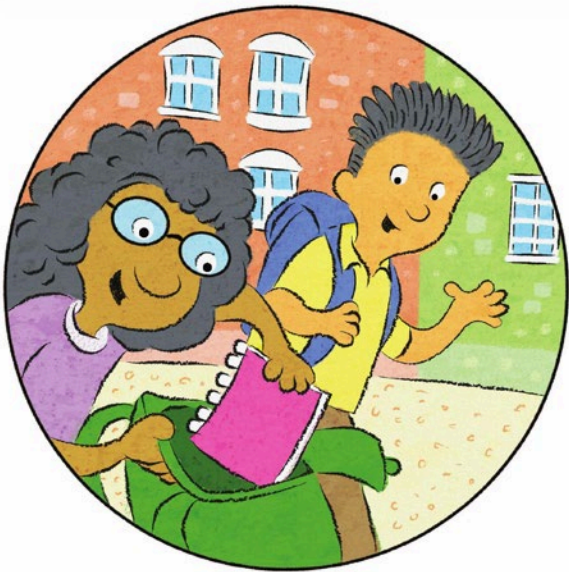
Walkthrough progress PLAN TEACH ASSESS

Student sample page: **Student Book**



Find the Student Book *Forces All Around* in your sample and turn to page 6.

In Lesson 1.3, the teacher models the reading activity by marking evidence of forces in the Student Book with a sticky note. Partner reading guidelines are provided and can be posted on the classroom wall for reference.



“One point for me! I’m going to write that down.” I got a notebook out of my backpack.

“Hey! I see some evidence!” said Lee. “Your notebook was just sitting there in your backpack. Then your hand pulled on the notebook, and it moved. That was evidence of a force! One point for me, too.”

6

 GO ONLINE

Student Books are accessible digitally via the Library in the Global Navigation Menu on the left side of the screen.



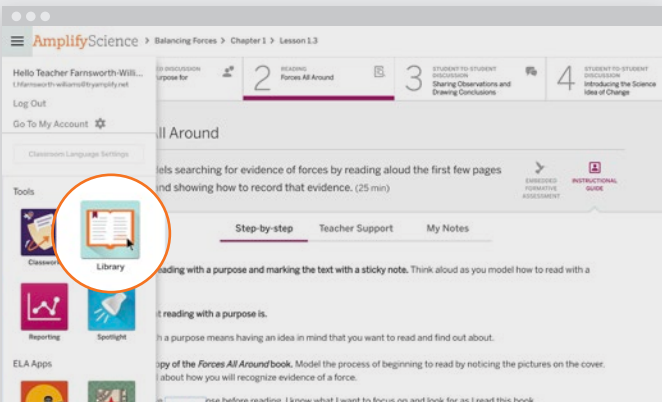
Classroom Slides, Lesson 1.3



Find the Student Book *Forces All Around* in your sample and turn to page 7.

Later in the lesson, students get the opportunity to discuss the forces they found while reading. The observations they share are added to a class chart, which the class then analyzes for patterns to deepen their understanding of key concepts.

Students also have the opportunity in Lesson 1.3 for discussion by sharing the forces they found in the book, which are added to a Class Observation Table, and the class analyzes patterns in the chart to deepen understanding of key concepts.



Student sample page: **Student Investigation Notebook**

Name: _____ Date: _____

Scientific Explanation of Why the Train Rises

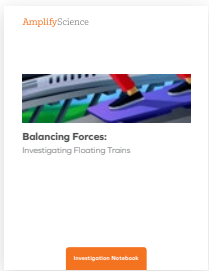
- Directions:
- 1. Write a scientific explanation that answers the question below.
 - 2. Your audience is the people of Faraday.

Why does the train rise?

The train rises because _____



Locate the *Balancing Forces* Student Investigation Notebook in your sample and turn to page 10.



At the end of Chapter 1, students engage in a formative assessment through writing a scientific explanation. Because this is the first time in the unit students are writing a scientific explanation, scaffolding is provided in the form of the teacher modeling how to write one. Students then work with a partner to write their topic sentence, before then finishing the explanation on their own. Over the course of the unit, the teacher gradually releases responsibility until students are writing explanations independently.



Classroom Slides, Lesson 1.4

 GO ONLINE

The full Student Investigation Notebook can be accessed digitally from the Unit Guide.

Walkthrough progress PLAN TEACH ASSESS

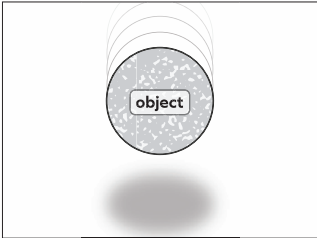
Name: _____ Date: _____

Diagramming Forces

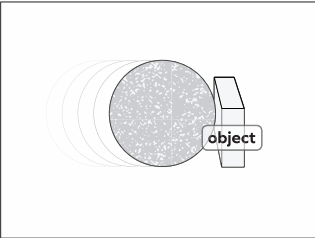
- Directions:
- 1. In each box, draw an arrow to show the direction of the force on the object that has the object label.
 - 2. Add labels to the diagram, using words from the Word Bank.

Word Bank				
push	pull	attract	repel	gravity
touching force		magnetic force		

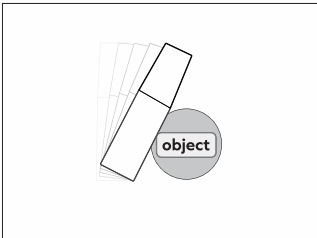
Falling ball



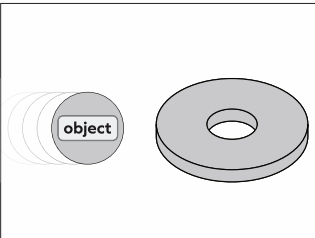
Ball hitting domino



Domino hitting ball magnet



Ball magnet moving toward ring magnet



Lesson 3.4: Modeling and Explaining the Falling Train

Activity 1

Diagramming Forces

Directions:

- 1. In each box, draw an arrow to show the direction of the force on the object that has the object label.
- 2. Add labels to the diagrams using words from the Word Bank.

Word Bank				
push	pull	attract	repel	gravity
touching force		magnetic force		

Falling ball

Ball hitting domino

Domino hitting ball magnet

Ball magnet moving toward ring magnet

Turn to page 36, Diagramming Forces, in your notebooks.

Complete the same diagrams in your Investigation Notebook as you work digitally.

Classroom Slides, Lesson 3.4



Turn to page 36 in the *Balancing Forces* Student Investigation Notebook.

In Lesson 3.4, students show what they've learned about forces as they complete diagrams showing direction of forces, and label the diagrams using vocabulary words.

AmplifyScience > Balancing Forces

Planning for the Unit

- Unit Overview
- Unit Map
- Progress Build
- Getting Ready to Teach
- Materials and Preparation
- Science Background
- Standards at a Glance

Teacher References

- Lesson Overview Compilation
- Standards and Goals
- 3-D Statements

Printable Resources

- Copymaster Compilation
- Investigation Notebook
- Multi-Language Glossary
- NGSS Information for Parents and Guardians
- Print Materials (8.5" x 11")
- Print Materials (11" x 17")

Offline Preparation

Teaching without reliable classroom internet? Prepare unit and lesson materials for offline access.

Offline Guide

Walkthrough progress PLAN TEACH ASSESS

Teacher sample page: Hands-on activity

Lesson 4.2
Activity 1

Balancing Forces
Lesson Guides

1

HANDS-ON
Floating Paper Clip
Challenge

2

3

Floating Paper Clip Challenge

Students cause a paper clip to float by using magnetic force to balance the force of gravity acting on the paper clip.



Instructional Guide

1. Review the Investigation Question. Read aloud the question on the board.

Why would an object not move even though a force is acting on it?

Remind students that they investigated this in the previous lesson. Invite volunteers to share what they discovered about this question. [Two forces can act on an object at the same time.]

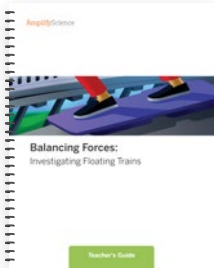
We've figured out that two forces can act on an object at the same time, but that still doesn't explain why an object doesn't move when those forces are being exerted on it. Today, we will continue to investigate this question.

2. Introduce the materials and the challenge. Hold up each of the materials students will use: large and small pieces of cardboard, plastic cup, and two ring magnets. Dangle one of the paper clips tied to a piece of string for students to see. Let students know that their challenge is to use these materials to build a device in such a way that the paper clips float in midair on the end of its string.

3. Distribute materials and have pairs work on the challenge. Distribute one large piece of cardboard, one small piece of cardboard, one plastic cup, several strips of masking tape, two ring magnets, and one paper clip attached to a piece of string to each pair of students. Encourage students to look to their classmates for ideas if they get stuck. Have students begin trying to make the paper clip float. If only a few pairs have succeeded after 5 or 10 minutes, have other pairs take a look at what those pairs have done.

4. Guide pairs to complete the device, if necessary. If students are still struggling to succeed at this challenge, you can guide the class in one way to complete the devices.

- Have students slip the string into the slit (beneath where the magnets will go) in the lower piece of cardboard and thread it underneath the device. The paper clip should end up on top of the cardboard base.



Turn to the Instructional Guide for Lesson 4.2 in the exemplar Teacher's Guide included in your sample.

In Lesson 4.2, students conduct a hands-on investigation called the Floating Paper Clip Challenge. In this activity, students build a physical model of a floating paper clip that shows how balanced forces are acting upon the paper clip.

Lesson 4.2: Investigating Balanced Forces

Activity 1

Build a device that makes the paper clip float in midair on the end of its string.

Classroom Slides, Lesson 4.2

GO ONLINE

In the Digital Resources for this Lesson (located in the Lesson Brief), teachers can access a setup guide for the hands-on investigation.

AmplifyScience

Balancing Forces > Chapter 4 > Lesson 4.1

Lesson Brief (4 Activities)

1 TEACHER-LED DISCUSSION: Resolving the Floating Train

2 HANDS-ON: Investigating Touching Force and Gravity

3 HANDS-ON: Investigating Magnetic Force and Other Forces

4 WRITING: Discussing and Writing About Two Forces Acting on an Object

Lesson Brief

Overview

Materials & Preparation

Differentiation

Standards

Vocabulary

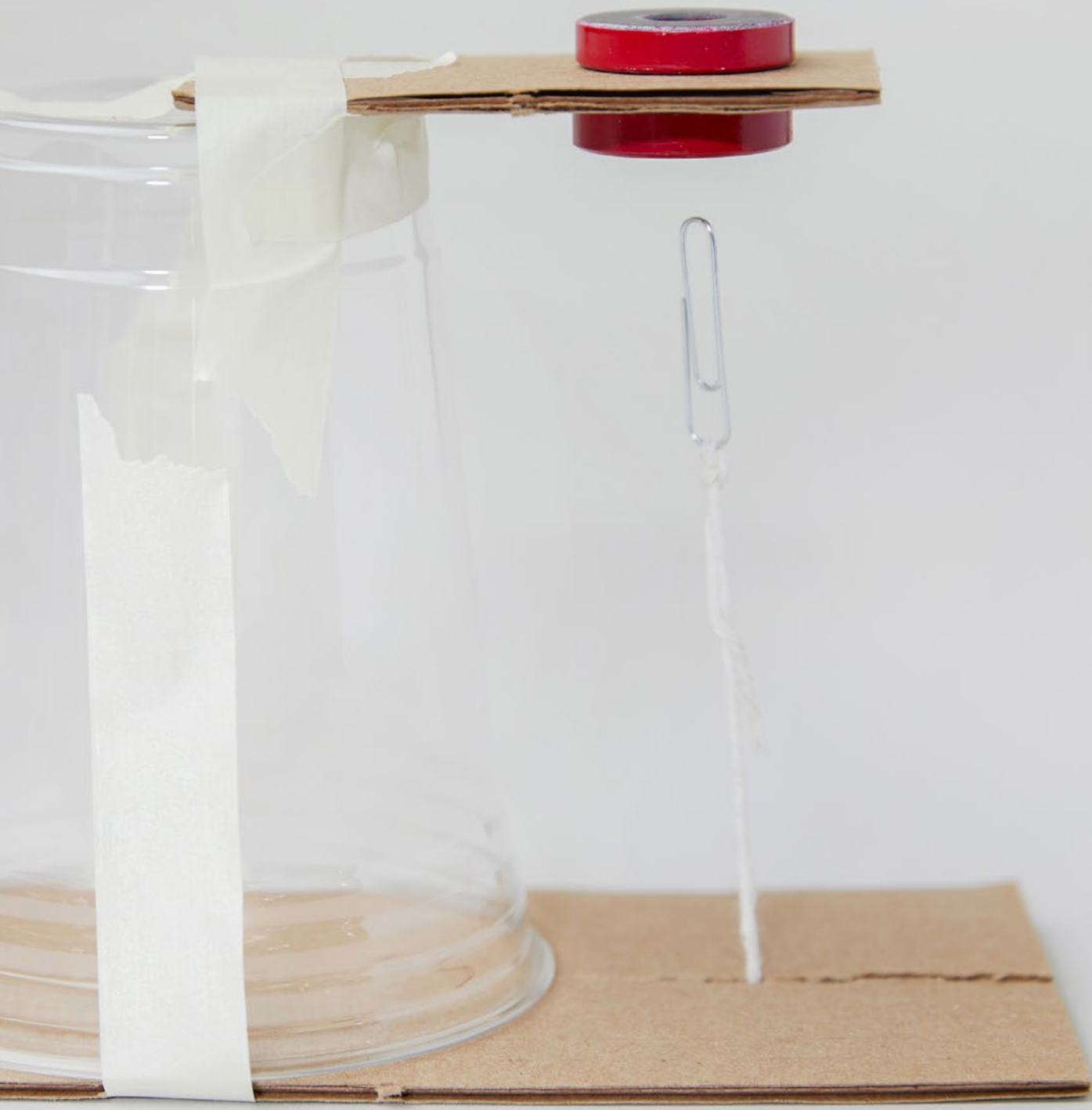
Unplugged?

Digital Resources

All Projections

Setting a Purpose for Investigating and Reading: Completed

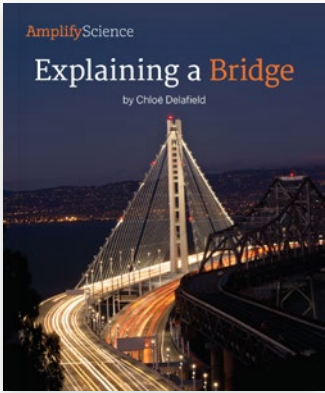
Projection: Lesson 4.1



Walkthrough progress

PLAN TEACH ASSESS

Student sample page: Student Book



Find the Student Book *Explaining a Bridge* in your sample and turn to page 5.

In Lesson 4.3, students are introduced to a new context for applying ideas about balanced forces with *Explaining a Bridge*. In this book, students meet an actual engineer who worked on the Bay Bridge, and he talks about how he thinks of forces when designing a bridge and how he communicates designs to the public by building models.



Workers built a new part of the bridge.



5

People remember that part of the old Bay Bridge fell. That makes some people afraid that the new bridge could fall. A man named Brian Maroney helps **explain** why the new bridge is safe.



GO ONLINE

Student Books are accessible digitally via the Library in the Global Navigation Menu on the left side of the screen.



Brian Maroney, bridge engineer

Maroney knows a lot about the new Bay Bridge. He is an **engineer** who works on bridges. An engineer is a person who **designs** things to solve problems. Maroney is one of the engineers who helped design the new Bay Bridge.

Lesson 4.2: Explaining a Bridge

Activity 1

As you read, use sticky notes to mark any evidence related to your reading purpose.

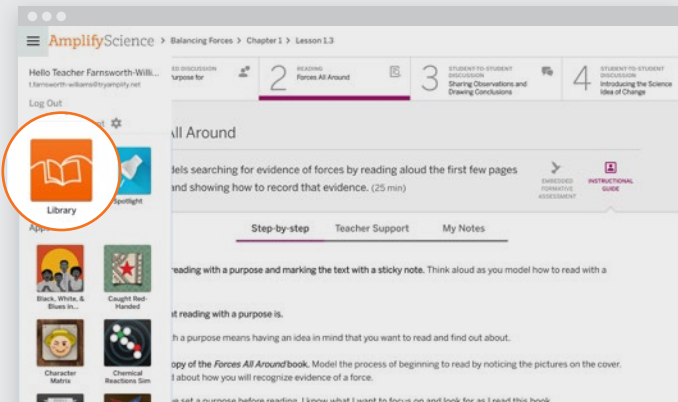
ON-THE-FLY

Classroom Slides, Lesson 4.2

6



Find the Student Book *Explaining a Bridge* in your sample and turn to page 6.



Walkthrough progress

PLAN

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Teacher sample page: Science practice tool

Balancing Forces
Lesson Guides

Lesson 4.4
Activity 1



1
MODELING TOOL
Diagramming and
Exploring the Floating
Paper Clip



2

3

Diagramming and Exploring the Floating Paper Clip



Students diagram a force with the Force Diagramming Tool and explore and ask questions about the Floating Paper Clip Device.

Instructional Guide

1. Introduce the lesson. Explain that today, students will first use the Force Diagramming Tool to make diagrams, and then they will investigate further with the Floating Paper Clip Device. Next, students will model, discuss, and write explanations about why the train floats.

2. Review the floating paper clip. Hold up a Floating Paper Clip Device with the paper clip floating.

What forces are being exerted on the paper clip?
[Downward force of gravity from Earth. Upward magnetic force from the magnets.]

Remind students that the upward and downward forces are balanced, which is why the paper clip is not moving.

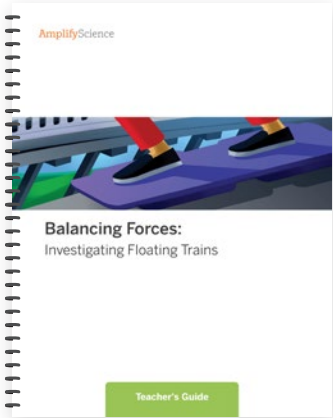
3. Give instructions for taking turns. Let students know that they will use the Force Diagramming Tool to make the diagram. When they finish, they will work on a challenge with the Floating Paper Clip Device. Before beginning, review the tasks.

4. Describe diagrams as models. Remind students that a diagram is a kind of model.

When observing the actual Floating Paper Clip Device, you can't actually see the forces involved. The models you make will help us understand what's going on by showing those forces.

5. Prepare the class for the activity in the Force Diagramming Tool. Go to the [Students Apps Page](#). Remind students to select the unit and then select Box 10 (4.4 Floating Paper Clip).

Who remembers the three things you need to do when turning this picture into a diagram?
[Identify the object, show the direction of the force, label the type of force.]

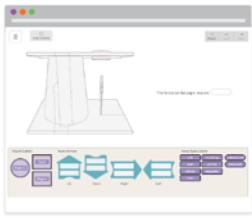


Turn to the Instructional Guide for Lesson 4.4 in the exemplar Teacher's Guide included in your sample to see a lesson where students access a digital modeling tool.

Remember the floating paper clip hands-on activity? In Lesson 4.4, students gain further experience exploring the floating paper clip by digitally diagramming the forces involved in it. Doing so prepares students to write a scientific explanation about the floating paper clip, while also providing the teacher an opportunity to see that students are making progress in their ability to create force diagrams.

Lesson 4.4: Modeling and Explaining Balanced Forces

Activity 1



Today, you will use the **Force Diagramming Tool** to investigate further with the Floating Paper Clip Device and **write explanations about why the train floats.**

Classroom Slides, Lesson 4.4

 GO ONLINE

Navigate to Chapter 4 of *Balancing Forces*, then click into Lesson 4.4, Activity 1: Diagramming and Exploring the Floating Paper Clip.

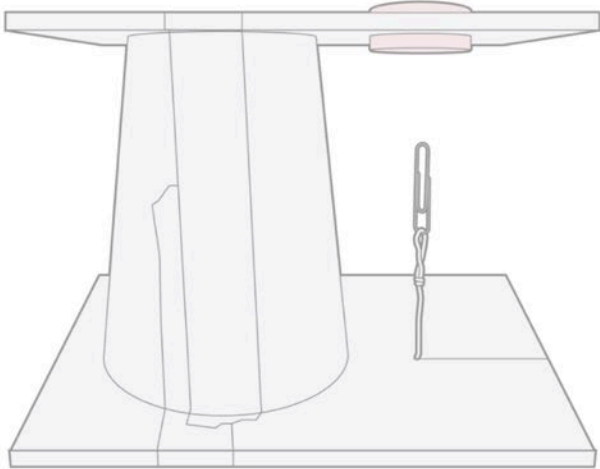
In the Instructional Guide, click the Student Apps page to access the modeling tool students use in this lesson.

Instructions

Reset

Undo

Redo



The forces on the paper clip are .

Object Labels

Object 1

Earth

Magnet

Force Arrows

Up

Down

Right

Left

Force-Type Labels

pull

push

attract

repel

touching

gravity

magnetic

unbalanced

balanced

Teacher and student sample page: **Assessment**

Lesson 5.5
Activity 1

Balancing Forces
Lesson Guides

1

WRITING
Writing a Scientific
Explanation About the
Floating Train

2

3

Writing a Scientific Explanation
About the Floating Train



Students write scientific explanations about the balanced and unbalanced forces involved in the floating train.

Instructional Guide

1. Introduce the writing task.

Now we are finally ready to do our final writing of this unit—to explain to the citizens of Faraday the answer to this question: *Why does the train change from floating to falling?*

When you write, you can draw upon all that you have learned about balanced and unbalanced forces, magnetic force, gravity, stability, and change.

2. Project and review notebook page 9, **What Is a Scientific Explanation?** Select the correct page in the table of contents. Review the purpose and features of a scientific explanation. Remind students that they can refer to these features on page 9 in their notebooks.

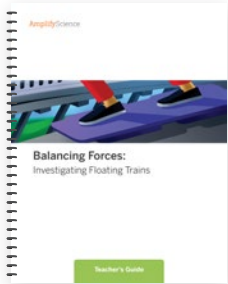
3. Have students turn to the diagrams (in their notebooks) they completed in Lesson 5.4. Have students turn to pages 70–71, **Diagramming the Floating Train**, in their notebooks. Let them know that they should refer to their diagrams as they write their scientific explanations.

Scientists often look at models, such as diagrams, they have made as they write explanations.

4. Distribute student sheets and review the directions. Distribute one set of the End-of-Unit Writing: Scientific Explanation of Why the Train Changes from Floating to Falling student sheet to each student. Go over each item in the directions:



Turn to the Instructional Guide for Lesson 5.5 in the exemplar Teacher’s Guide included in your sample to see a lesson in which students take a summative assessment.



At the end of the unit, students write their final explanations about why the train in Faraday changed from floating to falling. These written explanations provide a basis to assess each student's level of understanding of the core concepts from the unit, and also reveal students' developing facility with the science and engineering practice of Constructing Explanations.

Lesson 5.5: End-of-Unit Assessment: Students' Explanations

Activity 1

End of Unit Writing: Scientific Explanation of Why the Train Changes from Floating to Falling

Directions: Write a scientific explanation of why the train changes from floating to falling. Use the space below to write your explanation. Be sure to include the following information in your explanation:

1. What forces are acting on the train?

2. How do these forces change as the train moves?

3. How do these forces change as the train falls?

4. How do these forces change as the train lands?

You will write your explanation on this page.

Let's go over the instructions together.

Classroom Slides, Lesson 5.5

GO ONLINE

Navigate to the Lesson Brief for Lesson 5.5 and download the copymaster from the Digital Resources section on the right side of your screen.

AmplifyScience

Balancing Forces > Chapter 5 > Lesson 5.5

Lesson Brief (3 Activities)

1 WRITING
Writing a Scientific Explanation About the...

2 TEACHER LED DISCUSSION
Revisiting Anticipatory Charts

3 STUDENT TO STUDENT DISCUSSION
Investing with Magnets

RESET LESSON

GENERATE PRINTABLE LESSON GUIDE

Lesson Brief

Overview

Materials & Preparation

Differentiation

Standards

Vocabulary

Unplugged?

Digital Resources

End-of-Unit Writing: Scientific Explanation of Why the Train Changes from Floating to Falling copymaster

Assessment Guide: Assessing Students' End-of-Unit Explanations About the Floating Train

Optional: Scientific Explanation of Why the Train Changes from Floating to Falling, Version B copymaster

Optional: Chapter 5 Home Investigation: Sharing Your Train

Walkthrough progress

PLAN

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Teacher and student sample page: **Assessment**

Name: _____ Date: _____

**End-of-Unit Writing: Scientific Explanation
of Why the Train Changes from Floating to Falling**

Directions:

1. Write an explanation that answers the question below. Make sure you explain:
 - why the train was floating.
 - why the train falls.
 - why the train is stable sometimes and changes its motion sometimes.
2. Your audience is the people of Faraday.

Why does the train change from floating to falling?

Lesson 5.5: End-of-Unit Assessment: Students' Explanations

Activity 1

Name: _____ Date: _____

**End-of-Unit Writing: Scientific Explanation
of Why the Train Changes from Floating to Falling**

Directions:

1. Write an explanation that answers the question below. Make sure you explain:
 - why the train was floating.
 - why the train falls.
 - why the train is stable sometimes and changes its motion sometimes.
2. Your audience is the people of Faraday.

Why does the train change from floating to falling?

 Write your scientific explanation for why the train **changes from floating to falling**.

Classroom Slides, Lesson 5.5



Teachers can access an Assessment Guide for students' final written explanations in the Digital Resources section of the Lesson Brief for Lesson 5.5 Three rubrics are provided for assessing students' writing along several dimensions. These dimensions include attention to students' knowledge of balanced and unbalanced forces, students' understanding of stability and change, and students' ability to construct scientific explanations.

Rubric 1: Assessing Students' Performance of the Practice of Constructing Explanations			the Science Ideas Encountered in the Unit		Understanding of the Crosscutting Concept of Change	
Criteria	Description of level	Level		Score		Score
Causal and explanatory Does the explanation go beyond, or add to, what can be observed to explain the movement of the train?	The writing does not go beyond, or add to, what was observed to explain why the train changed from floating to falling. Possible feedback: You described what the townspeople saw the train do, but why did the train float and then fall? What determines the way in which an object moves? The writing goes beyond describing the observable movement of the train to propose: • why the train was sometimes stable and sometimes started moving. OR • the events and interactions that resulted in the train floating and then falling.	0	ing that an object's motion, stable or that are acting on it? (2 point)		A change in the train's motion as the ability in the train's motion as the	
	Possible feedback: You gave a partial explanation (e.g., that the train was stable when forces were balanced and started falling when they were unbalanced), but can you explain more fully why the train floated and fell (e.g., why were the forces sometimes balanced and sometimes unbalanced)?	1	is, or pushes and pulls, on the train, the train account for a change in the train's		All of the different forces that are he earth, magnetic force from the ity or change in motion? (1 point)	
	The writing goes beyond describing the observable movement of the train to propose: • why the train was sometimes stable and sometimes started moving. AND • the events and interactions that resulted in the train floating and then falling. Possible feedback: Is there anything else that could help someone understand why the train moved as it did?	2	ing that stability of motion (when forces on the object being balanced, train starts to fall) is the result of forces? (1 point)			0-2
(continued on next page)			rain floating as a result of the rain falling as a result of gravity rise to balance it.	0-3		

For more information on
Amplify Science, visit
amplify.com/sciencek5.

Amplify.



THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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