START HERE

Amplify Science

Grade 2

Instructional sampler

Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Amplify Science

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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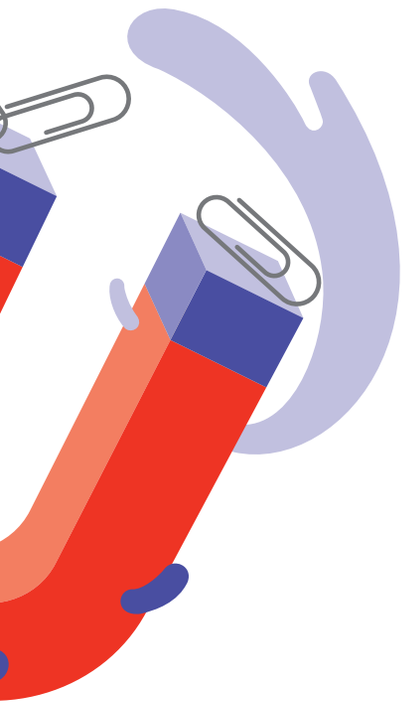



Gary's Sand Journal

About the program

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:

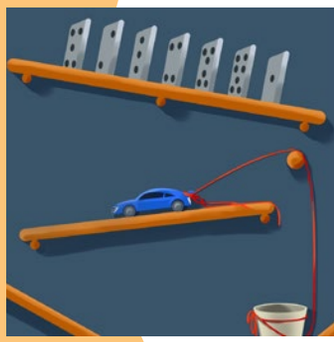
- ✔ **Collect evidence from a variety of sources.**
- ✔ **Make sense of evidence in a variety of ways.**
- ✔ **Formulate convincing scientific arguments.**

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

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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 middle 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.

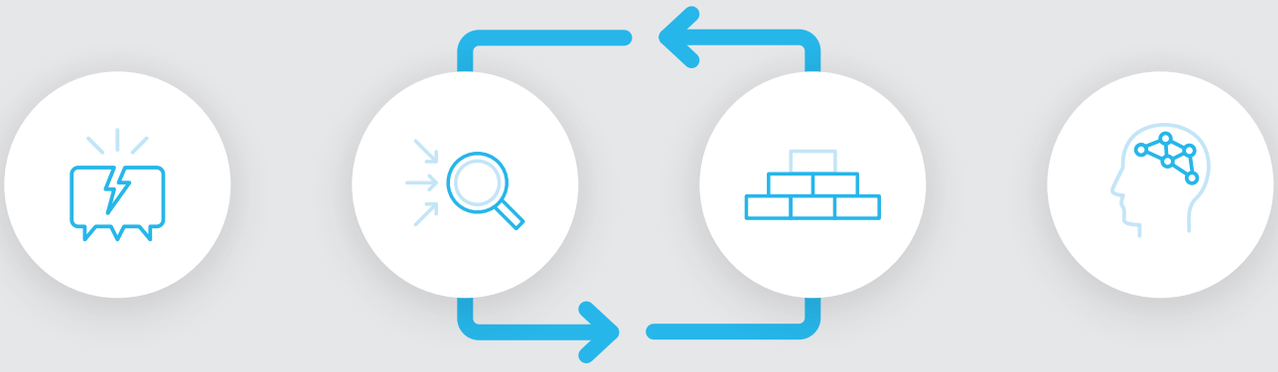
Sincerely,

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.



Engage students with a real-world problem

Explore evidence from multiple sources

Construct increasingly complex explanations

Apply knowledge to solve a different problem

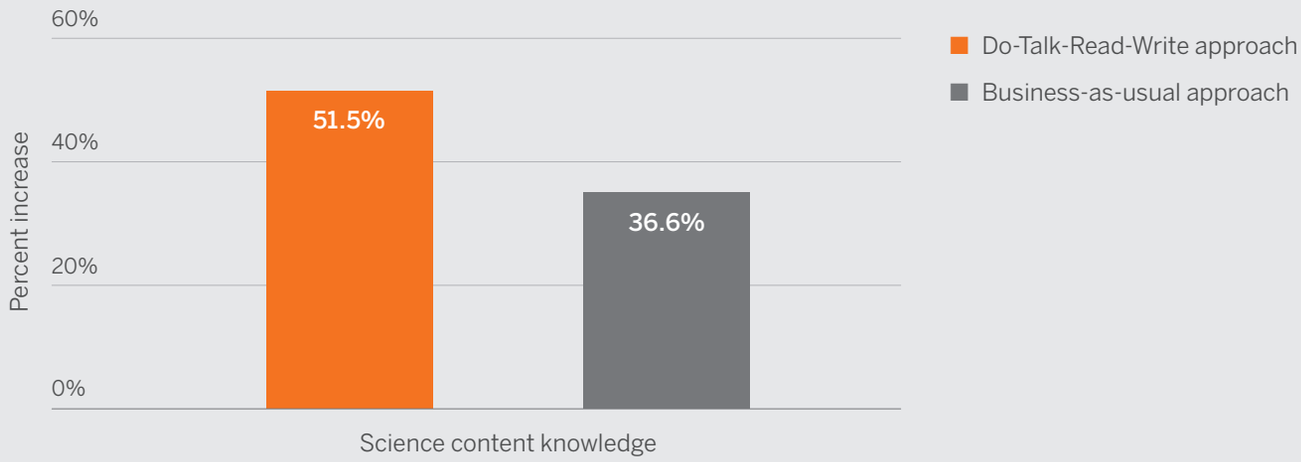
Grounded in research and proven effective

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

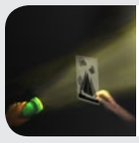
Needs of Plants and Animals
22 lessons (I)

Pushes and Pulls
22 lessons (E)

Sunlight and Weather
22 lessons (M)

Grade 1

Animal and Plant Defenses
22 lessons (M)



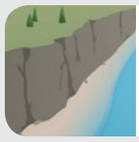
Light and Sound
22 lessons (E)

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

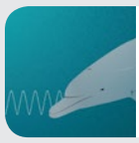
22 lessons

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

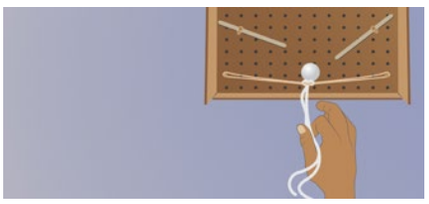
22 lessons

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

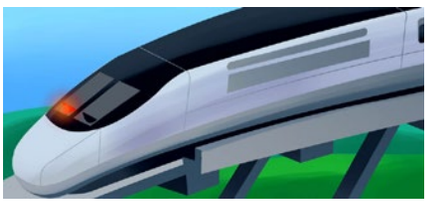
Why is the edge of the ocean cliff closer to the flagpole than it used to be?

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.

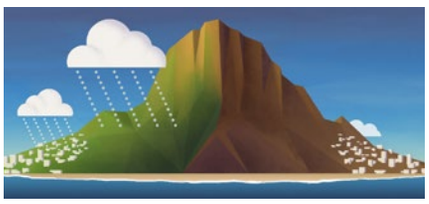
GRADE 4

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)

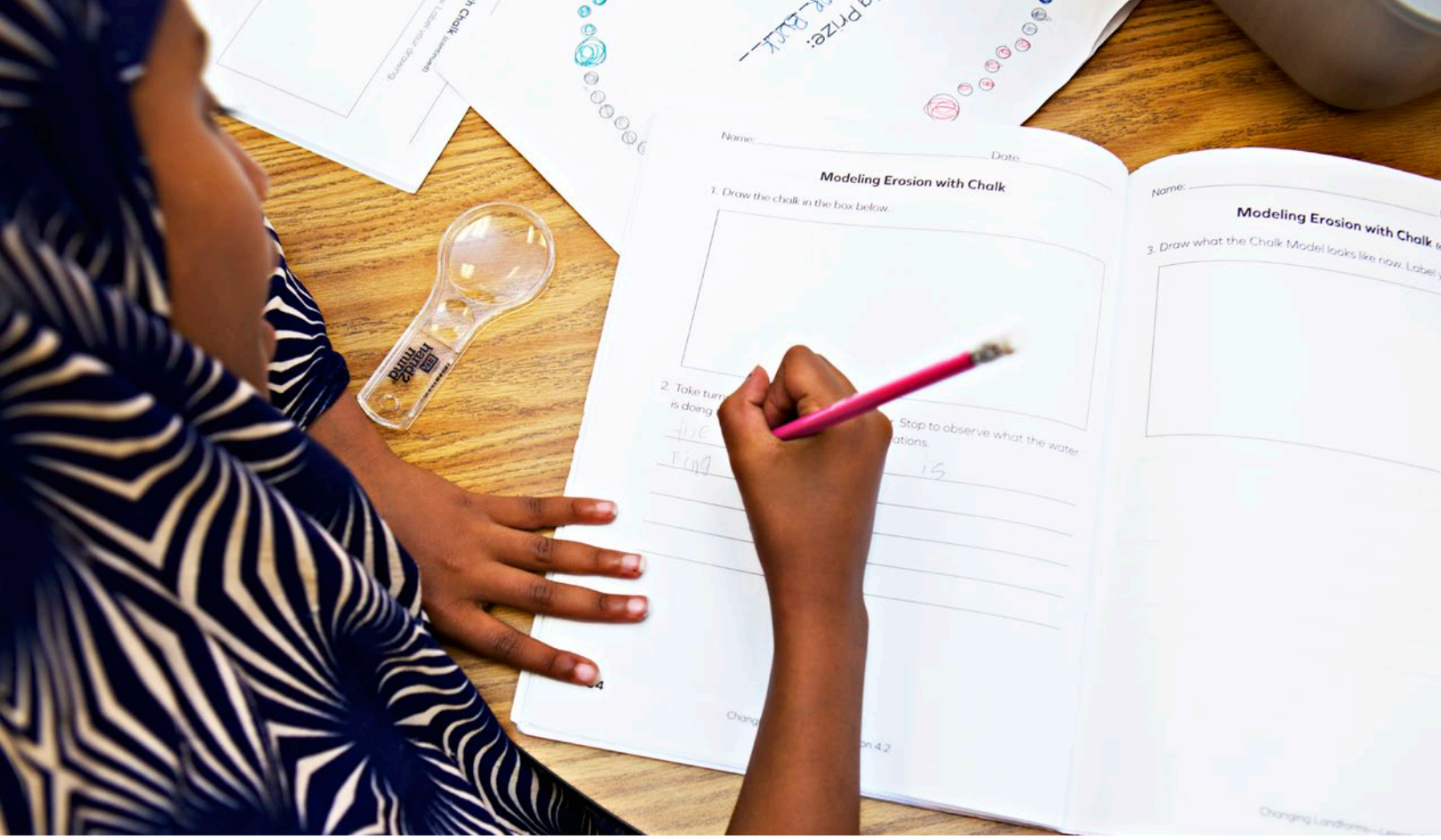
Multidimensional assessments integrated regularly throughout the lessons. OtFA opportunities were designed to help a teacher make sense of student activity during a learning experience and to provide evidence of how a student is coming to understand core concepts and developing dexterity with SEPs and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


KINDNESS
Gates 2nd Grade
CB Cart
#17

Engaging materials

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.

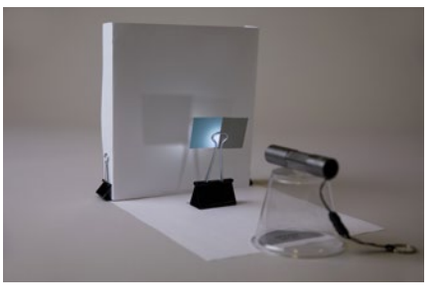
Examples

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.

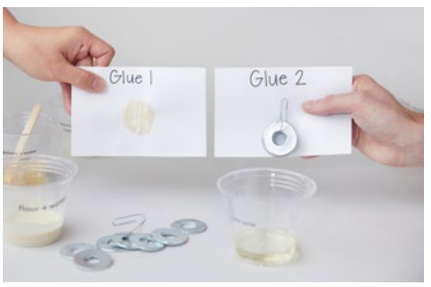


GRADE 1

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

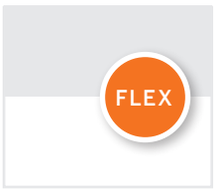
Properties of Materials

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 Flextensions

Hands-on Flextensions 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.

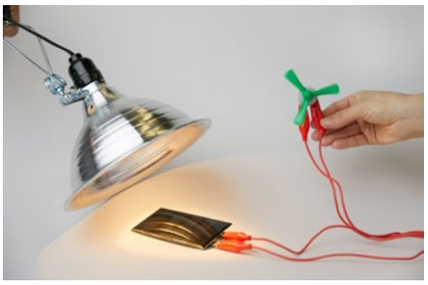
Materials referenced in Hands-on Flextension activities will either be included in the unit kit or are easily sourced. Supporting resources such as student worksheets will be included as downloadable PDF files.

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. In grades K–1, all Student Books are also included as Big Books for read-alouds.

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

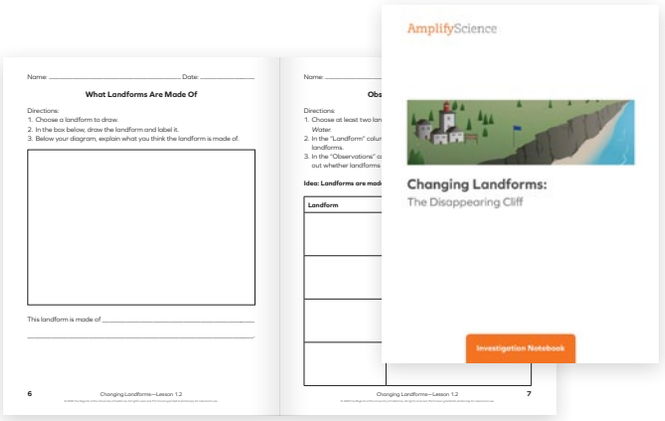
In Partner Reading mode, two students work together to read or gather information from a book. Partner Reading provides opportunities for each student in a pair to be the reader and the supporter while reading a text.

SPANISH LANGUAGE SUPPORT

All Student Books are also available in Spanish.

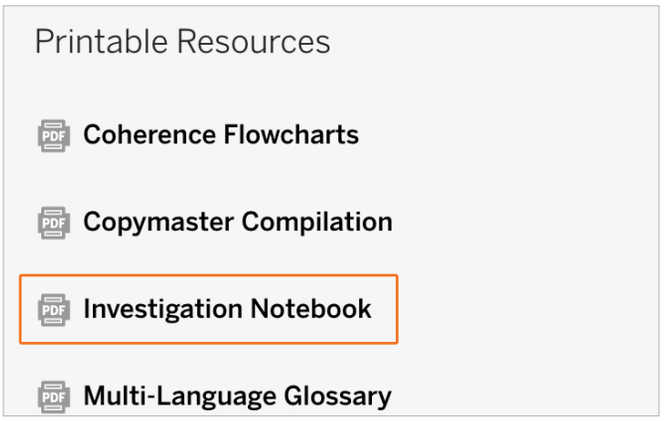
Student Investigation Notebooks

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.



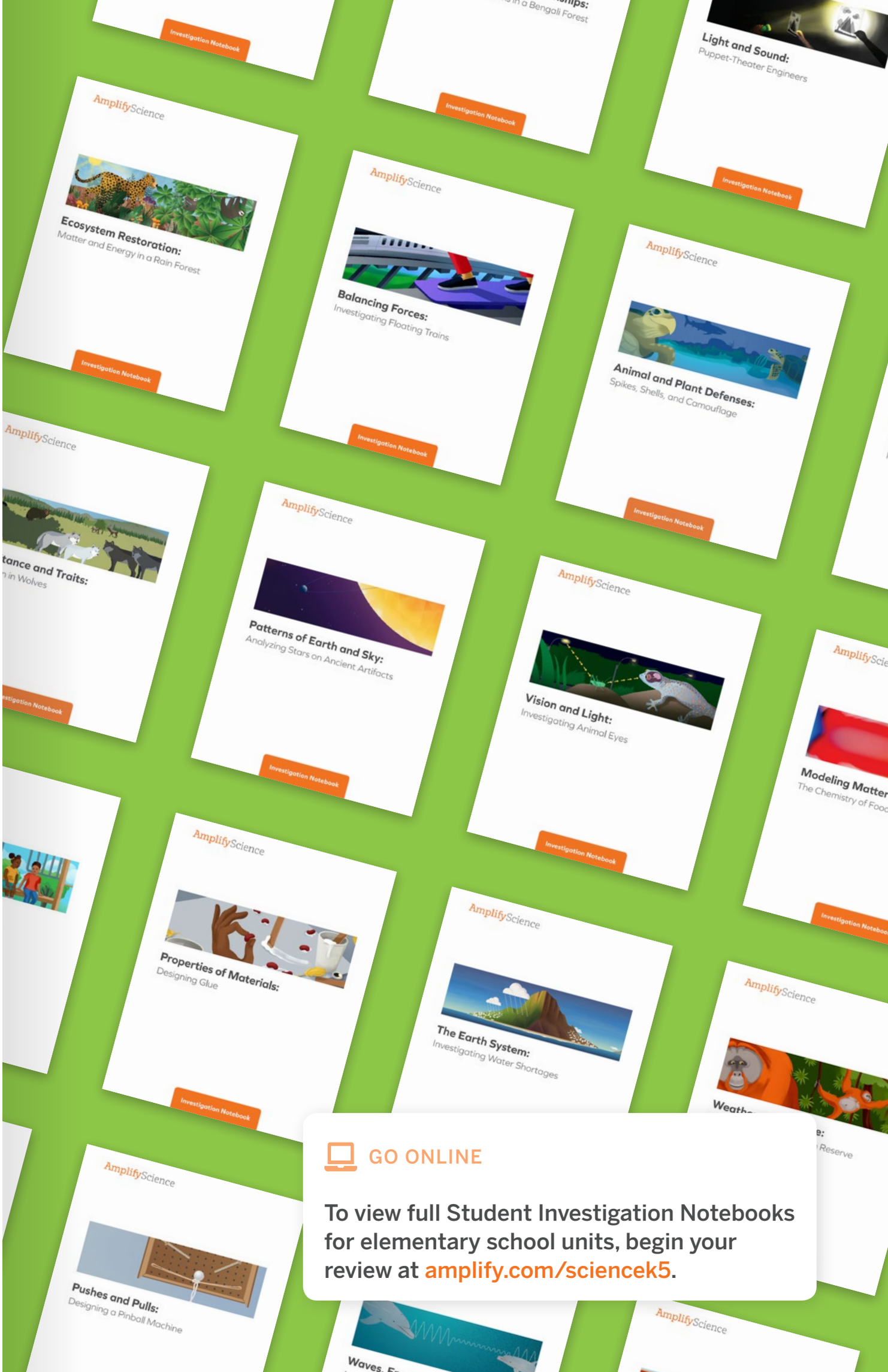
In grades K–5, one copy of the Student Investigation Notebook is included in each unit's materials kit for use as a blackline master.

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.



SPANISH LANGUAGE SUPPORT

All Student Investigation Notebooks are also available in Spanish.



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 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

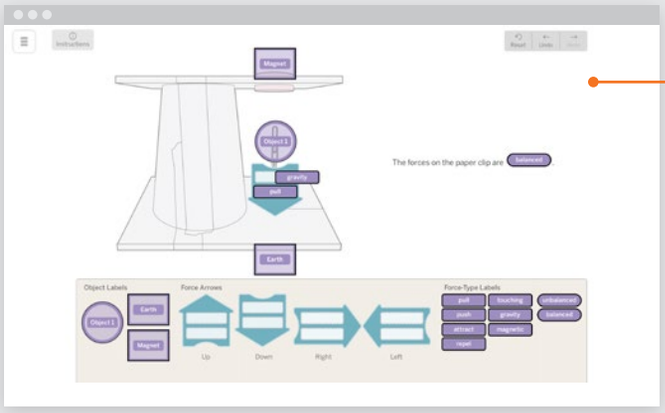
Students in grades 4 and 5 use digital tools and simulations more frequently, with 30–40 percent of lessons including opportunities to use a digital tool.

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

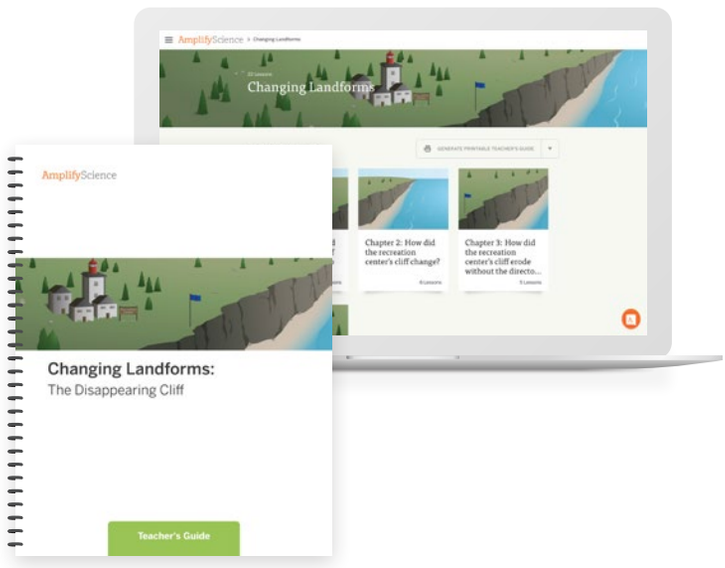
Data Tool

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.

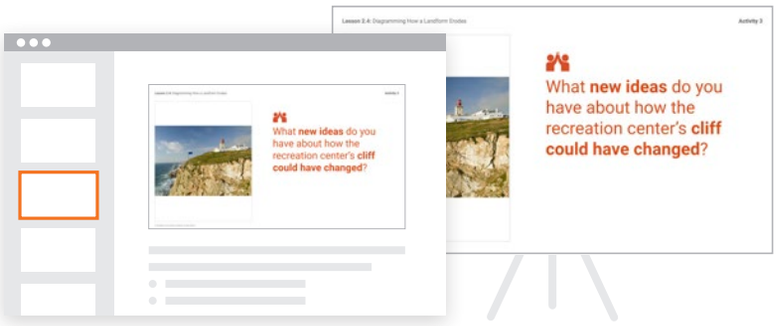
SPANISH LANGUAGE SUPPORT

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.

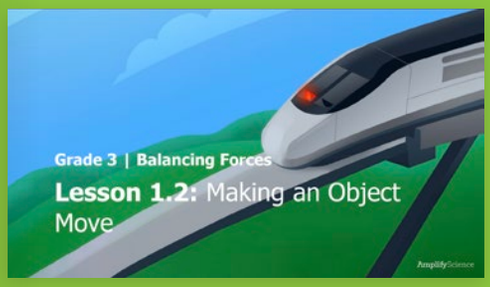
Deliver instruction

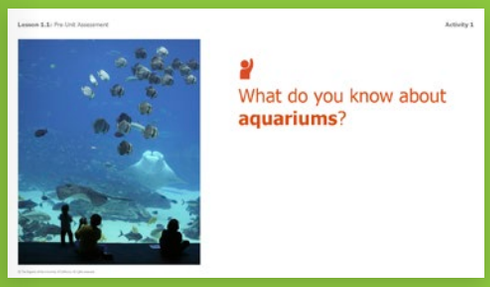


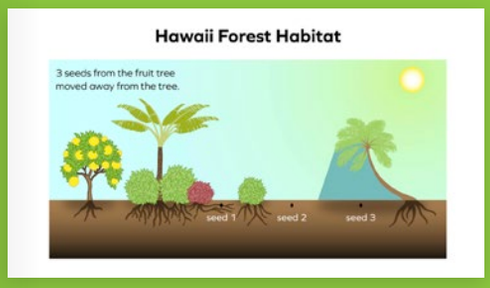
Classroom Slides

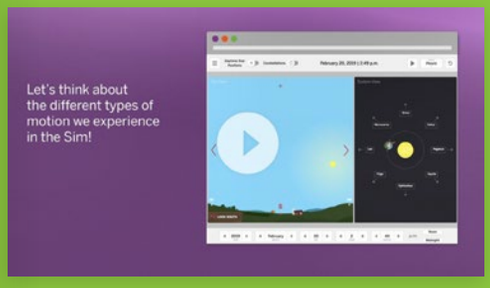
To make planning and delivering instruction faster and easier, Amplify has developed Classroom Slides for all K–5 lessons. Each lesson comes with a downloadable and editable PowerPoint file to help guide teachers and their students through the lesson with clearly-sequenced, engaging, and easy-to-follow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

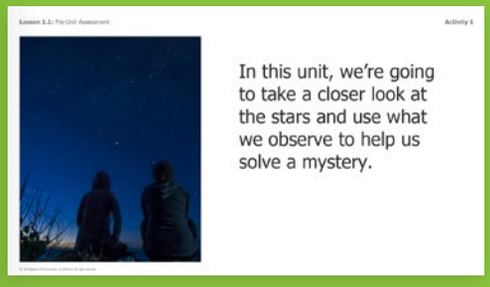
Classroom Slides allow teachers to easily customize their lessons and streamline the in-class presentation experience. Slides take key lesson content—including student-facing questions, teacher prompts, activity transitions, and visuals—and put it in a logical sequence. At any time, teachers can feel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

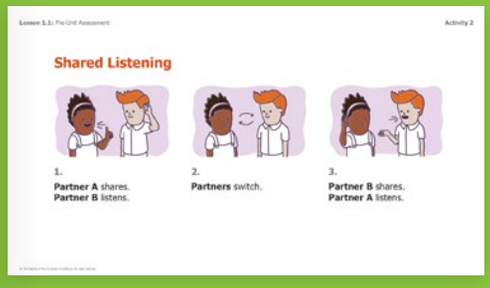












In your classroom

Grade 2: Year at a glance

Grade 2 in Amplify Science contains three units, each containing 22 total lessons: 20 60-minute lessons and two dedicated assessment days.

20 60-minute lessons
2 dedicated assessment days
Investigation focus

In *Plant and Animal Relationships: Investigating Systems in a Bengali Forest*, students dive deep into how plants depend on animals in their habitats. They pursue a chain of reasoning that takes them from considering how plants get what they need to grow, to understanding how seeds depend on animals for dispersal.

Student role and phenomena
Students assume the role of plant scientists reporting to the lead scientist at the Bengal Tiger Reserve, who has tasked students with explaining the unit's anchor phenomenon: New chalta trees are no longer growing there.

Insights
Along with firsthand experiences, students read informational texts, focus on how to plan and carry out investigations about plant needs, and engage in student-to-student discussions as they come to understand some challenging life science concepts.

Focal NGSS Performance Expectations:
2-LS2-1 • 2-LS2-2 • 2-LS4-1

20 60-minute lessons
2 dedicated assessment days
Engineering design focus

In *Properties of Materials: Designing Glue*, students discover that by mixing ingredients together, it's possible to create a mixture that takes on some of the properties of its ingredients.

Student role and phenomena
In this unit, students take on the role of glue engineers and use engineering design practices to create a glue for use at their school.

Insights
Over the course of the unit, students conduct tests that yield quantifiable results, graph their data, analyze and interpret results, and then use that evidence to iteratively design a series of glue mixtures, each one better than the one before.

Focal NGSS Performance Expectations:
5-PS1-1 • 5-PS1-2 • 5-PS1-3

Changing Landforms

22 Lessons

20 60-minute lessons
2 dedicated assessment days
Modeling focus

In *Changing Landforms: The Disappearing Cliff*, students use models to investigate how wind and water can cause landforms to change. They learn that landforms made of solid rock undergo small-scale changes and that, over time, these add up to big changes.

Student role and phenomena

In this unit, students take on the role of geologists in order to help the Oceanside Recreation Center Director understand what is happening to a collapsed cliff, and decide whether the center needs to be closed immediately.

Insights

Exploration and investigation of models (through both physical models and student-made diagrams) allow students to generate and explore questions about how wind and water change landforms. At the end of the unit, students consider a new anchor phenomenon to explain why the nearby cliff eroded overnight and use this information to discuss whether the same thing could happen to the recreation center's cliff.

Focal NGSS Performance Expectations:
5-ESS2-1 • 5-ESS2-2 • 5-ESS3-1 • 5-PS1-1 • 5-PS1-2
5-PS1-4 • 3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3

Deep dive: Changing Landforms

Take a closer look at the lessons and activities in the "Changing Landforms" unit.

CHAPTER 1 – DAY 1

Lesson 1.1
Pre-Unit Assessment

DAY 2

Lesson 1.2
Observations About Landforms

DAY 3

Lesson 1.3
Observing Sand Samples

DAY 6

Lesson 1.6
Explaining Landform Changes

CHAPTER 2 – DAY 7

Lesson 2.1
Diagramming Landform Changes

DAY 8

Lesson 2.2
Modeling Landform Changes

DAY 11

Lesson 2.5
Scale of Erosion

DAY 12

Lesson 2.6
Explaining How the Cliff Changed

CHAPTER 3 – DAY 13

Lesson 3.1
Introduction to Maps

DAY 16

Lesson 3.4
Landform Change Over Time

DAY 17

Lesson 3.5
End-of-Unit Assessment Part 1

CHAPTER 4 – DAY 18

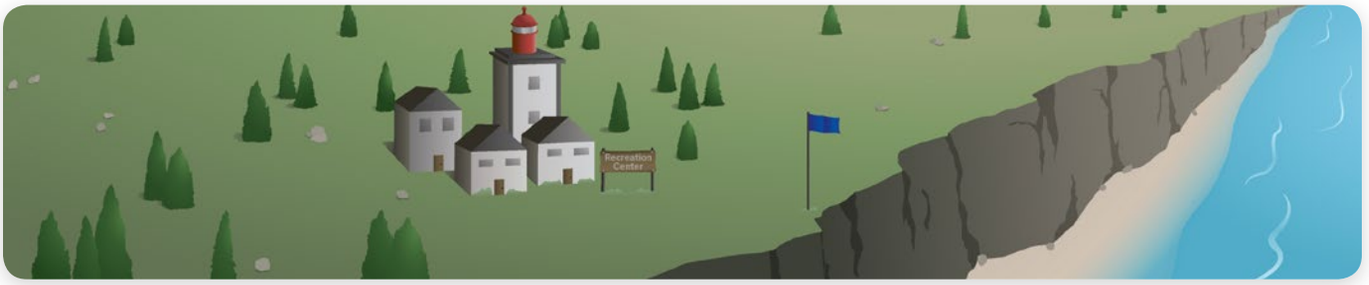
Lesson 4.1
Exploring How Landforms Erode Quickly

DAY 21

Lesson 4.4
Making Sense of How Landforms Erode Quickly

DAY 22

Lesson 4.5
End-of-Unit Assessment Part 2



DAY 4

Lesson 1.4
Gary's Sand Journal

DAY 5

Lesson 1.5
Making Sense of Sand Samples

DAY 9

Lesson 2.3
What's Stronger?

DAY 10

Lesson 2.4
Diagramming How a Landform Erodes

DAY 14

Lesson 3.2
Investigating Differences in Scale

DAY 15

Lesson 3.3
Accumulation of Small Changes

DAY 19

Lesson 4.2
Modeling How Landforms Erode Quickly

DAY 20

Lesson 4.3
Making Models of Streams

Lesson includes a reading activity with Student Books

Lesson includes a hands-on investigation

Lesson includes scientific writing activity

Lesson includes use of digital modeling tools

Dedicated assessment day

Lesson includes a discussion activity

Unit storyline: Changing Landforms

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

In *Changing Landforms: The Disappearing Cliff*, students use models to investigate how wind and water can cause changes to landforms. They learn that landforms made of solid rock undergo small-scale changes and that over time, these add up to big changes.

The unit begins with an introduction to changes in the cliffs by Oceanside Recreation Center. A nearby cliff has collapsed, and historical information shows that where the recreation center is situated appears to be receding. Students take on the role of geologists in order to help the Oceanside Recreation Center Director understand what is happening to the recreation center's cliff, and decide whether the center needs to be closed immediately.

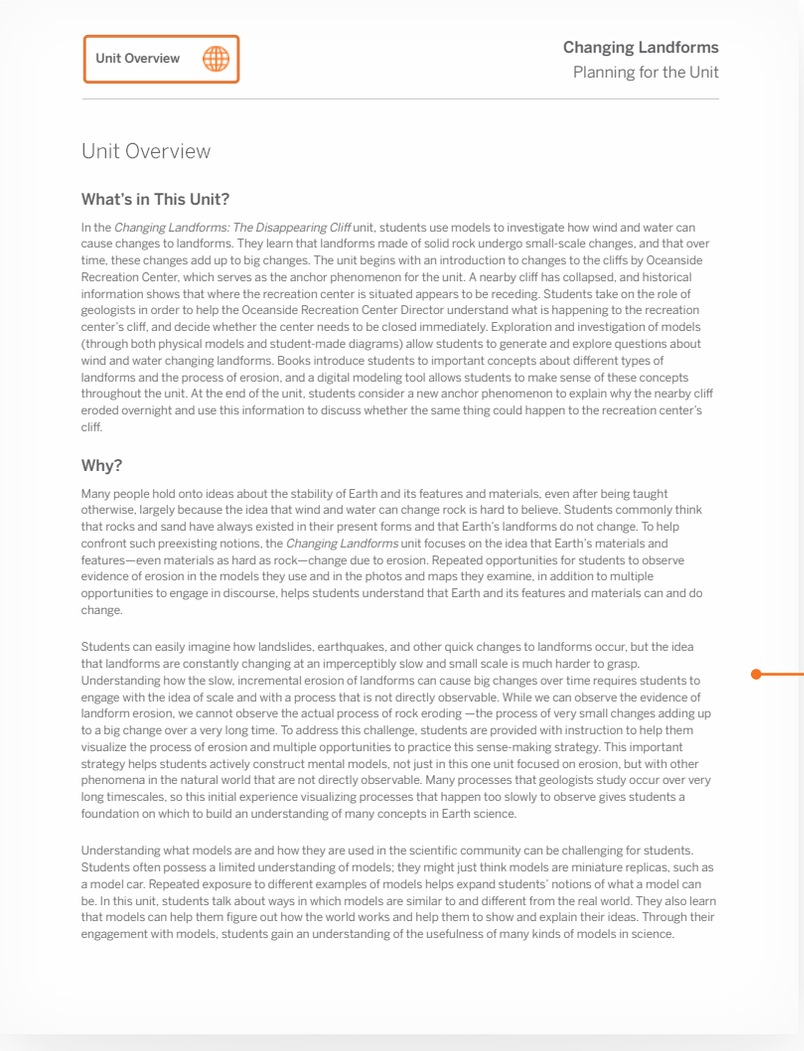
Exploration and investigation of models (through both physical models and student-made diagrams) allow students to generate and explore questions about how wind and water change landforms. Student Books introduce students to important concepts about different types of landforms and the process of erosion, and a digital modeling tool allows students to make sense of these concepts throughout the unit. At the end of the unit, students consider a new anchor phenomenon to explain why the nearby cliff eroded overnight and use this information to discuss whether the same thing could happen to the recreation center's cliff.

IN YOUR CLASSROOM

Sample unit walkthrough

Walkthrough progress PLAN TEACH ASSESS

Teacher sample page: Unit Overview



Unit Overview

Changing Landforms
Planning for the Unit

Unit Overview

What's in This Unit?

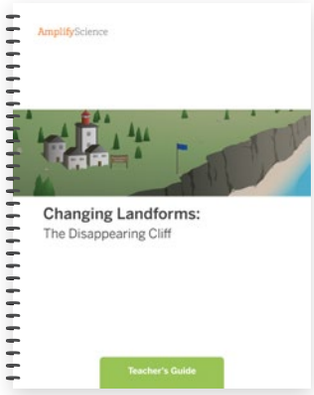
In the *Changing Landforms: The Disappearing Cliff* unit, students use models to investigate how wind and water can cause changes to landforms. They learn that landforms made of solid rock undergo small-scale changes, and that over time, these changes add up to big changes. The unit begins with an introduction to changes to the cliffs by Oceanside Recreation Center, which serves as the anchor phenomenon for the unit. A nearby cliff has collapsed, and historical information shows that where the recreation center is situated appears to be receding. Students take on the role of geologists in order to help the Oceanside Recreation Center Director understand what is happening to the recreation center's cliff, and decide whether the center needs to be closed immediately. Exploration and investigation of models (through both physical models and student-made diagrams) allow students to generate and explore questions about wind and water changing landforms. Books introduce students to important concepts about different types of landforms and the process of erosion, and a digital modeling tool allows students to make sense of these concepts throughout the unit. At the end of the unit, students consider a new anchor phenomenon to explain why the nearby cliff eroded overnight and use this information to discuss whether the same thing could happen to the recreation center's cliff.

Why?

Many people hold onto ideas about the stability of Earth and its features and materials, even after being taught otherwise, largely because the idea that wind and water can change rock is hard to believe. Students commonly think that rocks and sand have always existed in their present forms and that Earth's landforms do not change. To help confront such preexisting notions, the *Changing Landforms* unit focuses on the idea that Earth's materials and features—even materials as hard as rock—change due to erosion. Repeated opportunities for students to observe evidence of erosion in the models they use and in the photos and maps they examine, in addition to multiple opportunities to engage in discourse, helps students understand that Earth and its features and materials can and do change.

Students can easily imagine how landslides, earthquakes, and other quick changes to landforms occur, but the idea that landforms are constantly changing at an imperceptibly slow and small scale is much harder to grasp. Understanding how the slow, incremental erosion of landforms can cause big changes over time requires students to engage with the idea of scale and with a process that is not directly observable. While we can observe the evidence of landform erosion, we cannot observe the actual process of rock eroding —the process of very small changes adding up to a big change over a very long time. To address this challenge, students are provided with instruction to help them visualize the process of erosion and multiple opportunities to practice this sense-making strategy. This important strategy helps students actively construct mental models, not just in this one unit focused on erosion, but with other phenomena in the natural world that are not directly observable. Many processes that geologists study occur over very long timescales, so this initial experience visualizing processes that happen too slowly to observe gives students a foundation on which to build an understanding of many concepts in Earth science.

Understanding what models are and how they are used in the scientific community can be challenging for students. Students often possess a limited understanding of models; they might just think models are miniature replicas, such as a model car. Repeated exposure to different examples of models helps expand students' notions of what a model can be. In this unit, students talk about ways in which models are similar to and different from the real world. They also learn that models can help them figure out how the world works and help them to show and explain their ideas. Through their engagement with models, students gain an understanding of the usefulness of many kinds of models in science.

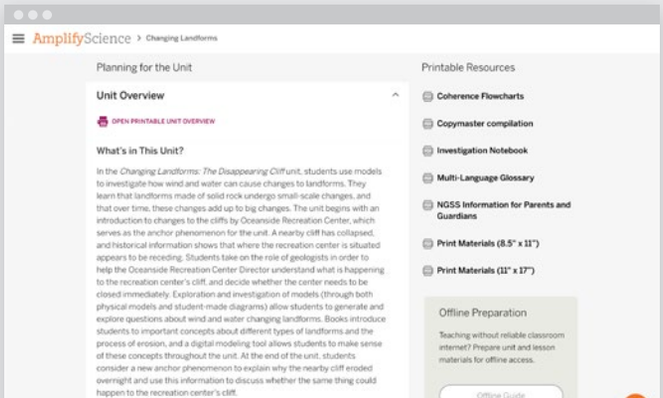


Find the Unit Overview in the exemplar Teacher's Guide included in your sample.

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.

GO ONLINE

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

Unit Map

Changing Landforms
Planning for the Unit

Unit Map

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

The director of the Oceanside Recreation Center got a scare when a nearby cliff collapsed, and he is worried that erosion on the recreation center's ocean cliff might have safety implications for the center's visitors. By taking on the role of geologists investigating landforms and erosion, students are able to advise the director on the prudence of keeping the center open, even though its cliff is also changing.

Chapter 1: How did the edge of the cliff get to be so close to the flagpole?

Students figure out: The shape of the cliff changed when the rock it is made of changed.

How they figure it out: Students read about and observe photos of different types of landforms as they gather evidence that landforms are made of rock. They investigate sand samples and see that sand is composed of tiny pieces of rock. They read a book about a scientist who makes inferences about the rock that the sand originated from based on its size, shape, and color. The class then visualizes how grains of sand can form and how landforms can change size and shape using a model where they shake pieces of hard candy. Students write a scientific explanation of how the shape of the cliff can change.

Chapter 2: How did the recreation center's cliff change?

Students figure out: Water hit the cliff and caused tiny pieces of the cliff to break off and move away.

How they figure it out: Students investigate the process by which landforms change. They observe images of landforms before and after big changes and discuss ideas about what might have caused the change to each landform. They identify water as an agent of change and use models with chalk to investigate how water can change a landform. They read how water—in both liquid and solid form—can erode landforms by causing pieces of rock to break off. Students diagram this process and conclude the chapter by writing an explanation of how landforms change.

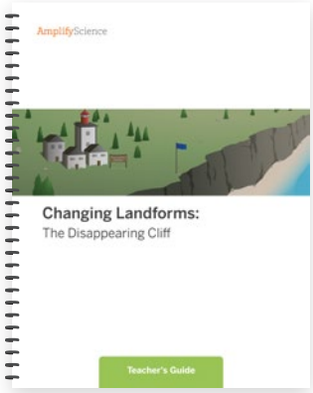
Chapter 3: How did the recreation center's cliff erode without the director noticing?

Students figure out: Because the pieces are so small, it took a really long time to observe a big change to the cliff.

How they figure it out: Students are introduced to maps as a tool for geologists studying changes to landforms. Using the reference book, students discuss features of maps and explore landforms from different perspectives. They use a digital modeling tool to create their own maps of landforms. Using a model made of pom-poms that represents a mountain, students erode the model to show how many small changes (difficult to notice) can add up to a bigger change (easy to notice). Students also consider the scale of time and conclude that perceptible changes to landforms usually take a very long time. Finally, students write explanations and create diagrams that explain how the recreation center's cliff eroded without the director noticing.

Chapter 4: Could the recreation center's cliff erode quickly?

Students figure out: The nearby cliff eroded quickly because it is made of loose materials, such as clay and dirt, which are not as strong as rock. When wind or water hits the cliff, big pieces can break off. This causes the cliff to change more quickly than rock would.

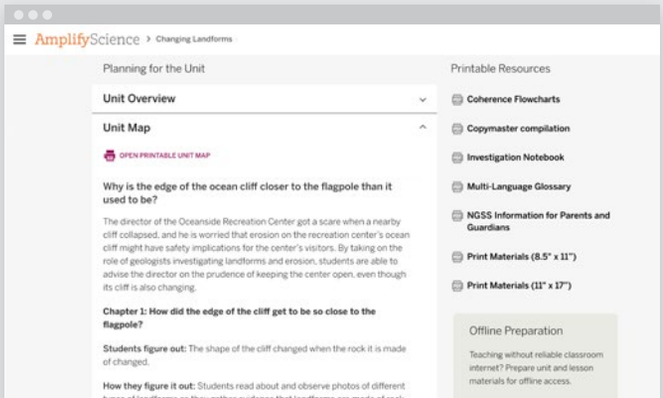


Find the Unit Map in the exemplar Teacher's Guide included in your sample.

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.

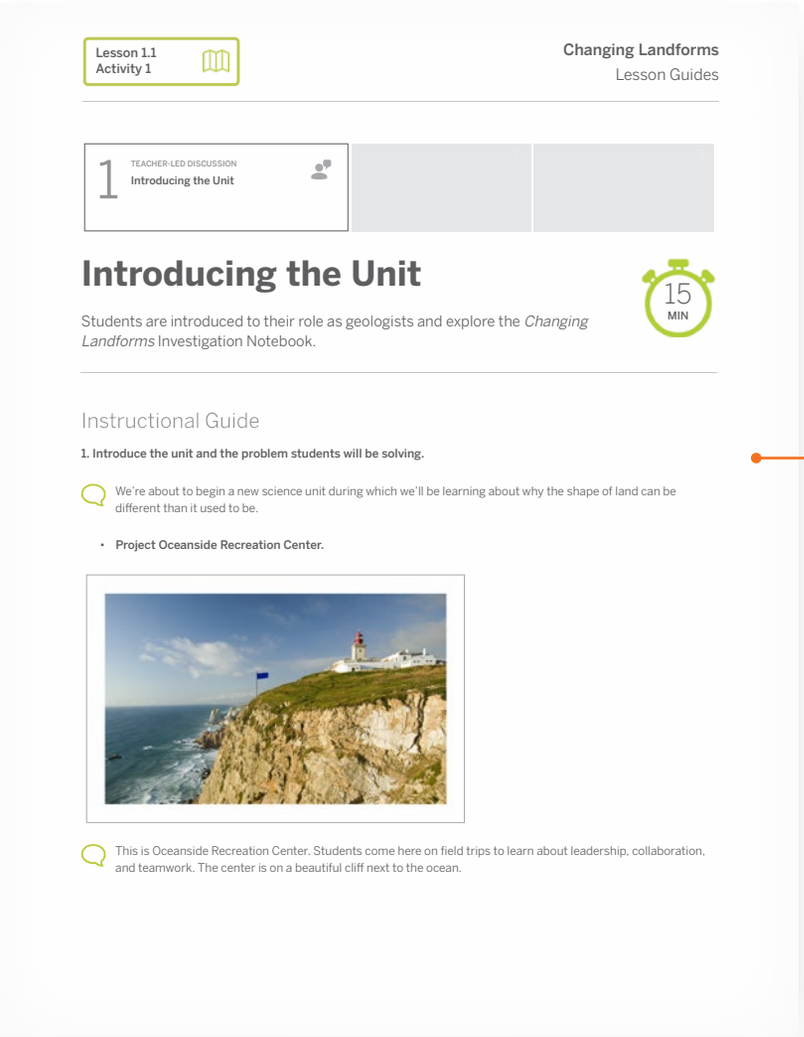
GO ONLINE

To access the 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 PLAN TEACH ASSESS

Teacher sample page: Instructional Guide



Lesson 1.1
Activity 1

Changing Landforms
Lesson Guides

1 TEACHER-LED DISCUSSION
Introducing the Unit

Introducing the Unit

15 MIN

Students are introduced to their role as geologists and explore the *Changing Landforms* Investigation Notebook.

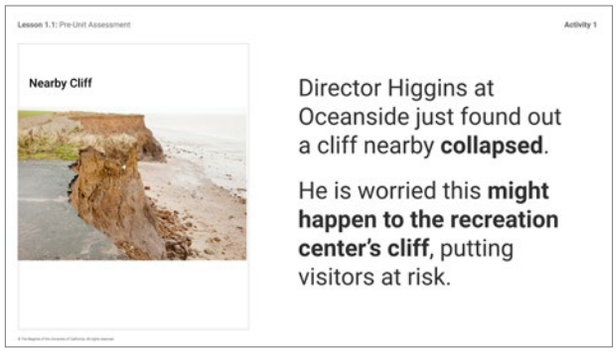
Instructional Guide

1. Introduce the unit and the problem students will be solving.

We're about to begin a new science unit during which we'll be learning about why the shape of land can be different than it used to be.

- **Project Oceanside Recreation Center.**

This is Oceanside Recreation Center. Students come here on field trips to learn about leadership, collaboration, and teamwork. The center is on a beautiful cliff next to the ocean.



Classroom Slides, Lesson 1.1

Find the Instructional Guide for Lesson 1.1 in the exemplar Teacher's Guide included in your sample.

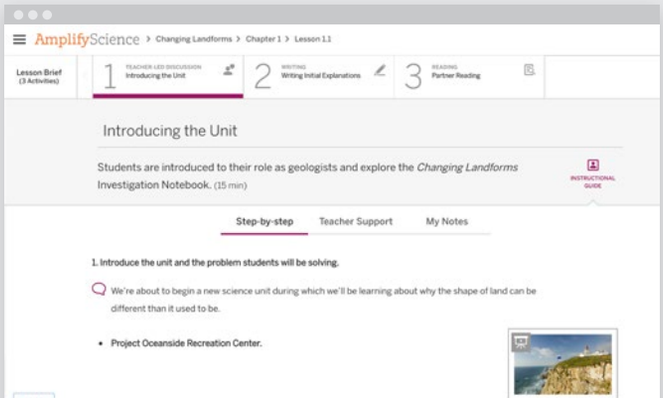
The Instructional Guide contains step-by-step instructions for teachers, including teacher talk and discussion prompts.

In Lesson 1.1 of *Changing Landforms*, students are introduced to the unit and the central problem they will solve: how the edge of a particular cliff got to be closer to a flagpole than it used to be.

Students also complete a pre-unit writing assessment to demonstrate what they already know about how landforms change and to provide a baseline from which to measure growth in understanding over the course of the unit.

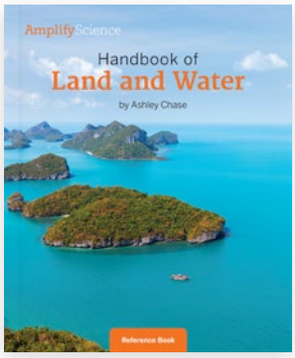
GO ONLINE

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



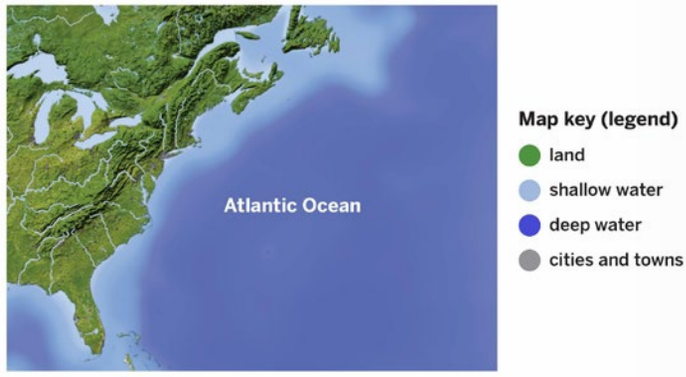
Find the Student Book *Handbook of Land and Water* included in your sample and turn to page 32.

In Lesson 1.2, students preview the unit's reference book, *Handbook of Land and Water*, familiarizing themselves with the different landforms and bodies of water included in the book.

This preliminary use of the reference book prepares students to use the book as a source of secondhand data, just as scientists do, in the next activity and throughout the unit. As they read, students make observations about the different landforms in the book to use as evidence to support the idea that landforms are made of rock.

View of the Atlantic Ocean

Map of the Atlantic Ocean Off the Coast of North America



32 Ocean

GO ONLINE

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

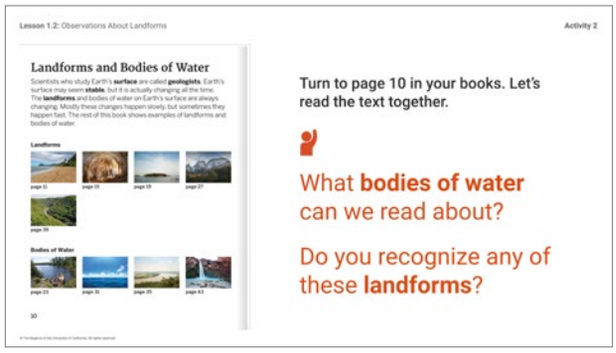
How the Ocean Changes Slowly

The water level of the ocean changes very slowly over time. In the past, the water level was lower than it is now. The water level is getting higher. As the water level rises, water covers more of the land. The **diagram** below shows how this happens.

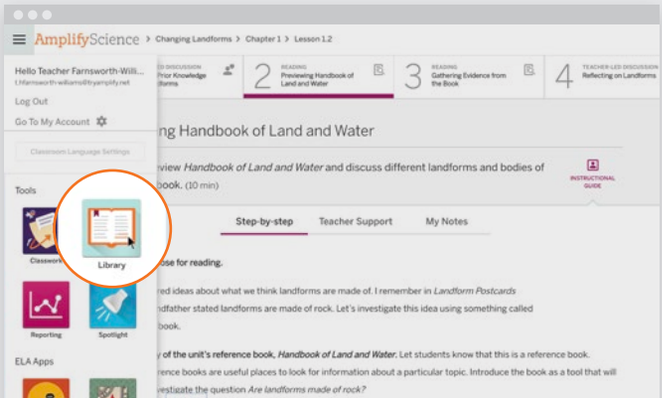
1. **Long ago, the ocean water level was lower than it is now.**

2. **Over time, the water level has been getting higher. Now water covers new parts of the land.**

3. **After many years, the water rises on all sides of some mountains, turning them into islands.**

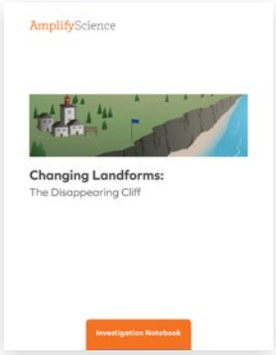


Classroom Slides, Lesson 1.2



Walkthrough progress PLAN TEACH ASSESS

Student sample page: Student Investigation Notebook

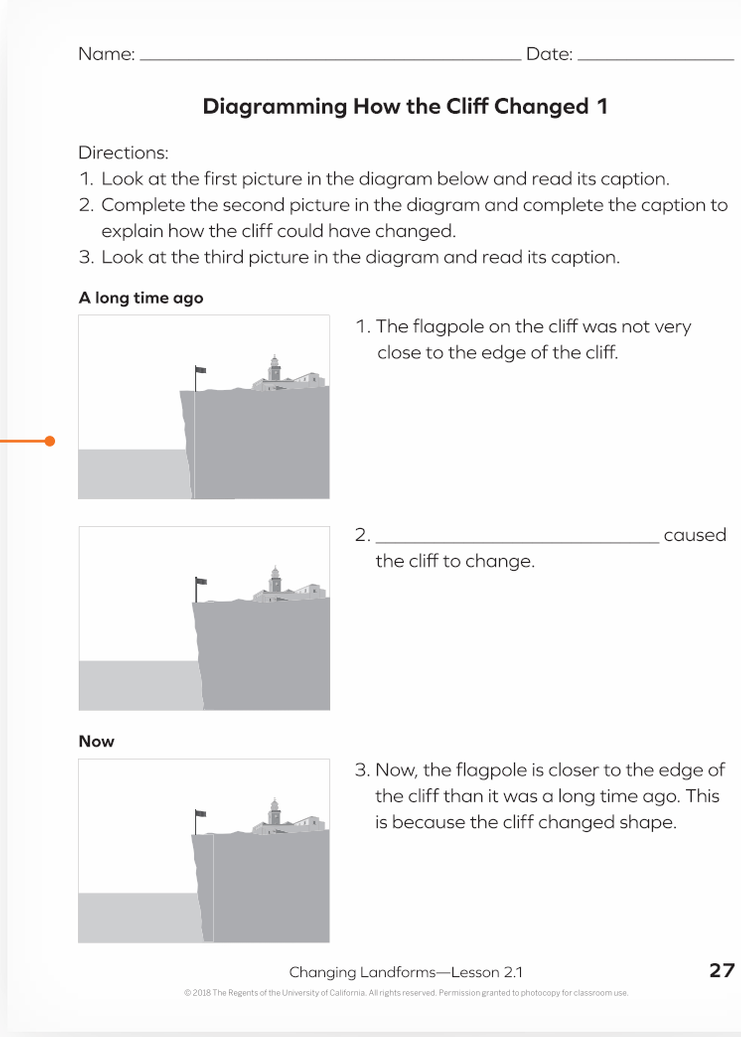


Turn to page 27 in the *Changing Landforms* Student Investigation Notebook included in your sample.

In Lesson 2.1, students prepare to investigate causes of the change in the recreation center's cliff by visualizing and discussing their initial ideas of what may have caused the cliff to change.

In their Student Investigation Notebooks, students record their initial ideas about how landforms change, which they will later revise—allowing them to reflect on how their thinking has changed.

After diagramming landform changes, students observe and discuss pictures of landforms that changed, leading them to identify water as a possible agent of landform change.



Name: _____ Date: _____

Diagramming How the Cliff Changed 1

Directions:
1. Look at the first picture in the diagram below and read its caption.
2. Complete the second picture in the diagram and complete the caption to explain how the cliff could have changed.
3. Look at the third picture in the diagram and read its caption.

A long time ago

1. The flagpole on the cliff was not very close to the edge of the cliff.

2. _____ caused the cliff to change.

Now

3. Now, the flagpole is closer to the edge of the cliff than it was a long time ago. This is because the cliff changed shape.

Changing Landforms—Lesson 2.1 27

GO ONLINE

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

Name: _____ Date: _____

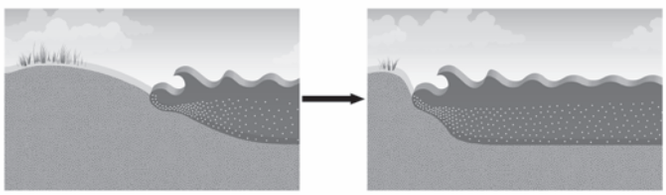
Landform Changes

Directions:

1. Observe the landform in both pictures. With a partner, discuss what changed about the landform.
2. In each picture, circle the part or parts of the landform that changed.
3. Look for evidence of what could make the landform change.
4. Answer the question below each pair of pictures.

Changes to a Beach

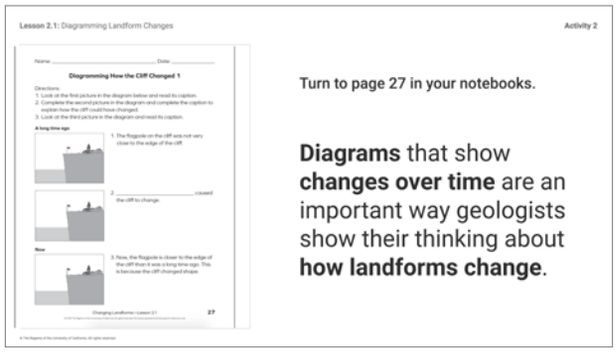
A long time ago Now



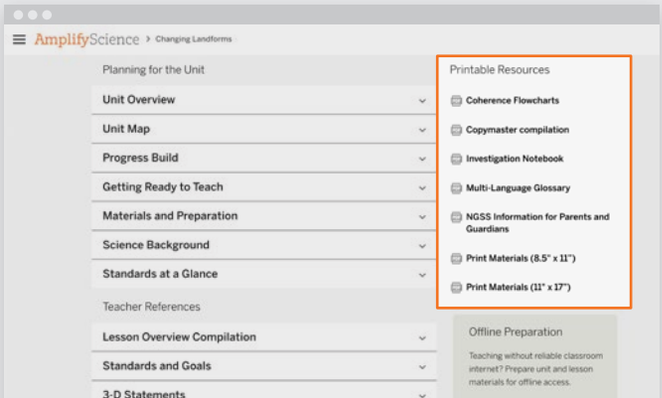
What do you think made the beach change?

_____

_____



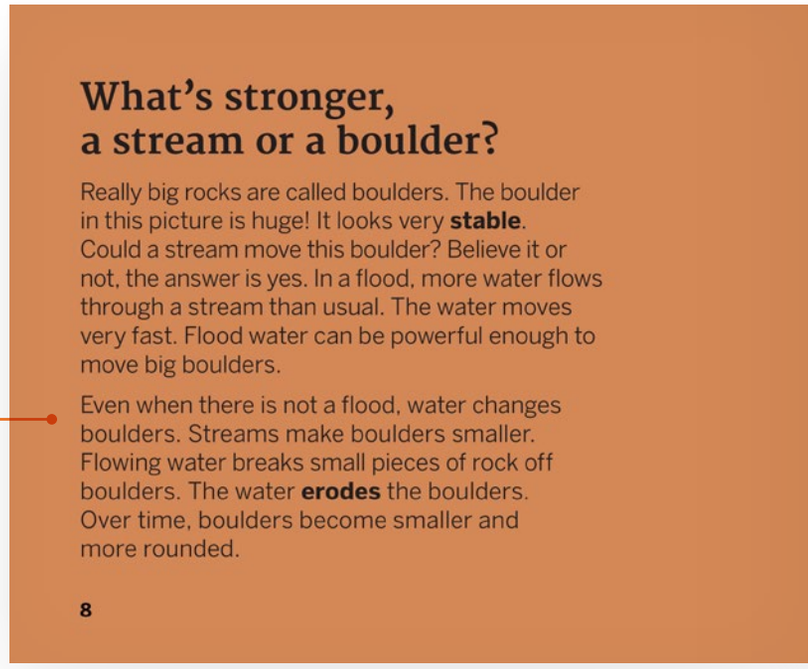
Classroom Slides, Lesson 2.1



Walkthrough progress PLAN TEACH ASSESS

Student sample page: Student Book

Find the *What's Stronger? How Water Causes Erosion* Student Book included in your sample and turn to page 8.



What's stronger, a stream or a boulder?

Really big rocks are called boulders. The boulder in this picture is huge! It looks very **stable**. Could a stream move this boulder? Believe it or not, the answer is yes. In a flood, more water flows through a stream than usual. The water moves very fast. Flood water can be powerful enough to move big boulders.

Even when there is not a flood, water changes boulders. Streams make boulders smaller. Flowing water breaks small pieces of rock off boulders. The water **erodes** the boulders. Over time, boulders become smaller and more rounded.

8

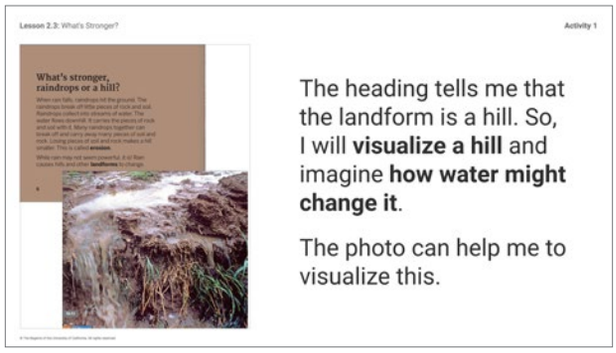
In Lesson 2.3, students preview the Student Book *What's Stronger? How Water Causes Erosion* with the teacher before a Partner Reading activity.

During Partner Reading, students gather evidence about how water can change the shape of a landform, and they get more practice visualizing. This activity includes an On-the-Fly Assessment to assess students' developing facility with the sense-making strategy of visualizing.

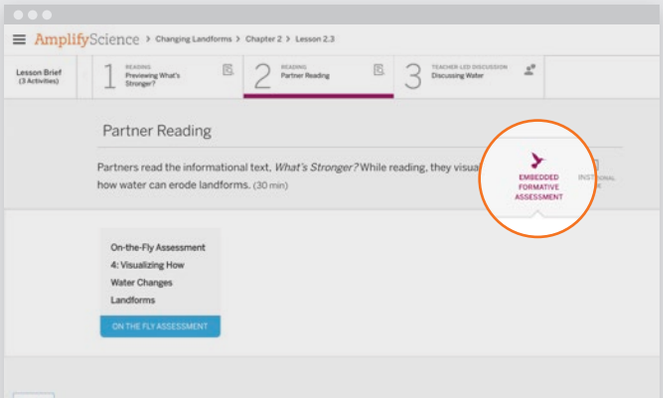
After reading, the class discusses how water can change the shape of landforms.

GO ONLINE

Teachers can access On-the-Fly Assessments within the digital Teacher's Guide by clicking the bird icon in the Instructional Guide for the lesson.



Classroom Slides, Lesson 2.3



Walkthrough progress PLAN TEACH ASSESS

Teacher and student sample page: Digital modeling tool

Lesson 3.1
Activity 4

Changing Landforms
Lesson Guides

4 MODELING TOOL
Creating Digital Maps

Creating Digital Maps

25 MIN

Students use the *Changing Landforms* Modeling Tool to create maps to show what landscapes look like from a bird's-eye view.

Instructional Guide

1. Introduce the *Changing Landforms* Modeling Tool. Explain that now that students have practiced visualizing what places look like from above, they will use an app to create maps of different landforms.

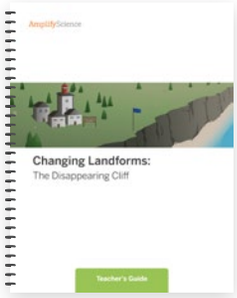
2. Project Guidelines for Using Apps. Review each guideline with students. Feel free to add your own guidelines as needed.

Guidelines for Using Apps

- Only one person "drives" at a time.
- Anyone can make suggestions about how to use the app.
- Talk about what you observe.
- Rotate the role of "driver."

3. Project the *Changing Landforms* Modeling Tool and demonstrate the activity. Go to the Student Apps Page. Show students how to select the unit and then Box 1, 3.1 Beach Map.

- With 3.1 Beach Map projected, model visualizing the beach from above. Point out the photo of the beach and think aloud as you visualize looking down at the beach from above.



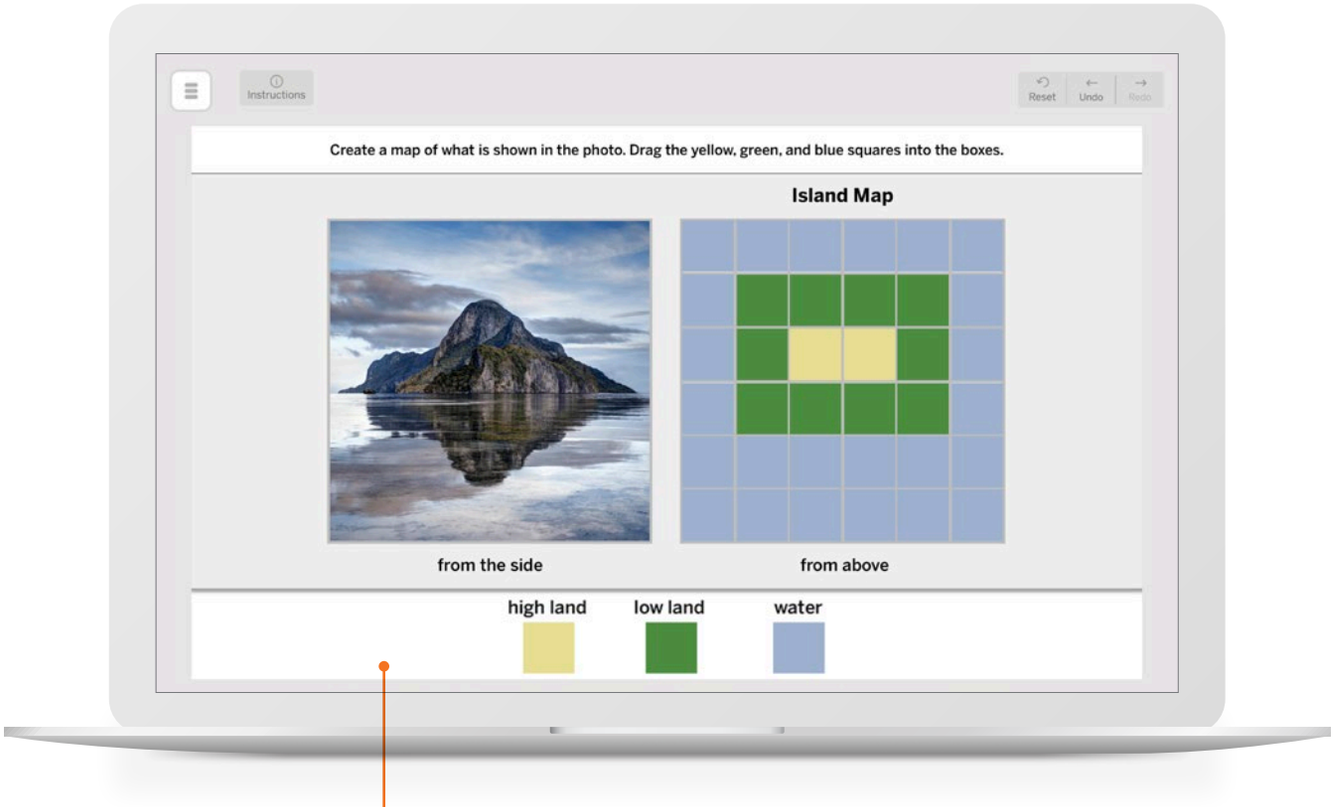
Turn to the Instructional Guide for Lesson 3.1 in the exemplar Teacher's Guide included in your sample.

In Lesson 3.1, students revisit the *Handbook of Land and Water* reference book to help them understand how to read a map using a map key and different perspectives.

Classroom Slides, Lesson 3.1

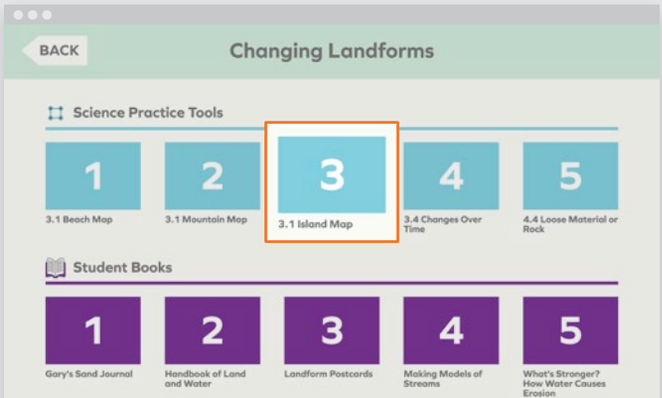
GO ONLINE

The *Changing Landforms* modeling tool is available with one click at point-of-use in the Instructional Guide or through the Elementary Student Apps page.



The reference book prepares students to use the *Changing Landforms* modeling tool to create simple maps to represent the landforms shown in side-view photos. This gives students another opportunity to practice visualizing and shifting their perspective from a side view to a bird's-eye view.

Creating these maps develops students' understanding of how maps represent land and water and will help them interpret maps in future lessons.



Walkthrough progress PLAN TEACH ASSESS

Teacher sample page: Hands-on activity

Changing Landforms
Lesson Guides

Lesson 4.2
Activity 2

2 HANDS-ON
Modeling Erosion

Modeling Erosion

25 MIN

Students investigate the Chalk Model and Sand Model. They compare the models and note how the sand eroded more quickly.

Instructional Guide

1. Introduce the hands-on investigation. Let students know they will work in groups of four to investigate the Chalk Model and the Sand Model, using spray bottles filled with water, just as they did to erode chalk in Chapter 2.

2. Briefly review the guidelines for working with the models.

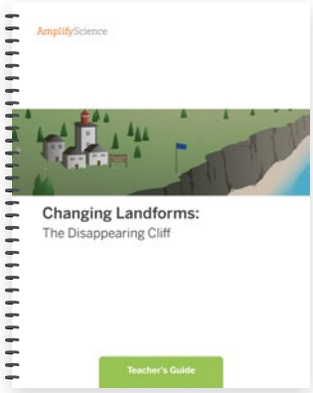
- Explain that students should not touch the chalk or sand.
- Remind students that they should only point spray bottles at the chalk and sand.
- Let students know that they should wear safety goggles and move their notebooks out of the way while spraying.
- Explain that students can use hand lenses to get a closer look.

3. Have students turn to page 64, Modeling Erosion with Chalk, in their notebooks.

- Explain that students will first draw the chalk before spraying it with water.
- Students will take turns spraying the chalk. They will observe what happens and record their observations on the notebook page.
- Explain that students will then turn to page 65, Modeling Erosion with Chalk (continued), in their notebooks and draw what the Chalk Model looks like after spraying the water.

4. Designate groups of four and distribute one tray of materials to each group. Ask students to set aside the container with sand in it for now. They will work with the Chalk Model first.

5. Have students observe the chalk and draw it in their notebooks before spraying it with water.



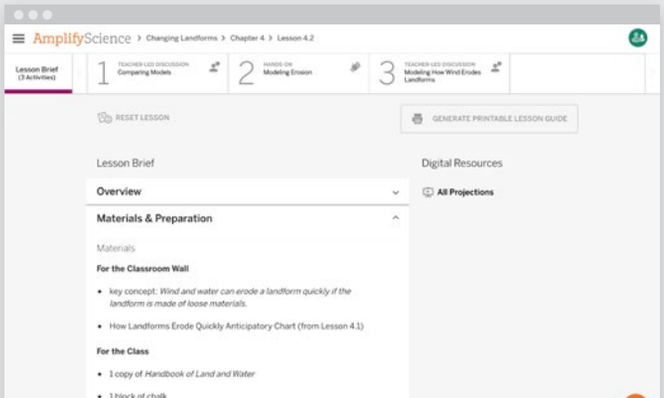
Turn to the Instructional Guide for Lesson 4.2 in the exemplar Teacher's Guide included in your sample.

Lesson 4.2 includes a hands-on investigation in which students investigate two models, which supports their visualization of how a landform made of loose materials erodes quickly.

Students use two models made of different materials to investigate how water can cause some landforms to erode quickly and others more slowly, observing what happens to chalk when it is sprayed with water and what happens to sand when it is sprayed with water.

GO ONLINE

The Lesson Guide for each lesson includes a Materials & Preparation section, which details materials needed for that lesson and information on how to set up your classroom for the lesson.



Walkthrough progress PLAN TEACH ASSESS

Teacher and student sample page: End-of-Unit Assessment

Lesson 4.5
Activity 3

Changing Landforms
Lesson Guides

3 WRITING
Writing Scientific Explanations

Writing Scientific Explanations

20 MIN

Students write scientific explanations about why the nearby cliff eroded overnight.

Instructional Guide

1. Let students know they will now write scientific explanations.

You have just discussed and diagrammed ideas about what caused the nearby cliff to erode quickly. It is now time to explain to Director Higgins why this happened to the nearby cliff.

2. Have students turn to page 79, End-of-Unit Writing: Explaining the Nearby Cliff, in their notebooks.

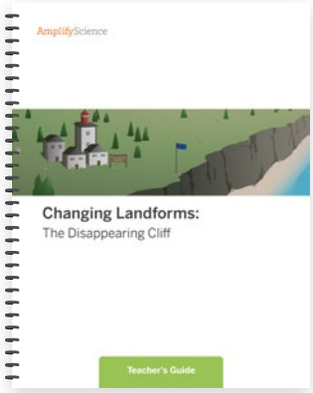
3. Project What Is a Scientific Explanation?

What Is a Scientific Explanation?

1. It answers a question.
2. It is based on science ideas you have learned.
3. It is shared with someone.
4. It uses science words.

- Read the first guideline aloud and then point out the question that is on notebook page 79.

It answers a question. The question you will answer is *Why did the nearby cliff erode overnight?*



Find the Instructional Guide for Lesson 4.5 in the exemplar Teacher's Guide included in your sample. Turn to page 79 in the *Changing Landforms* Student Investigation Notebook included in your sample.

The final lesson of the unit begins with students using new evidence to draw new diagrams of how the nearby cliff eroded.

Students then have the opportunity to apply their understanding of ideas when they write scientific explanations about why the nearby cliff eroded overnight.

GO ONLINE

Navigate to the Lesson Brief for Lesson 4.5 and download the Assessment Guide from the Digital Resources section on the right side of your screen.

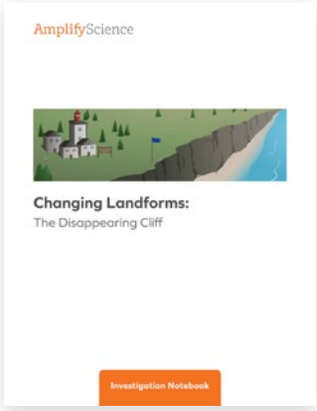
Name: _____ Date: _____

End-of-Unit Writing: Explaining the Nearby Cliff

Directions:
Write a scientific explanation that answers the question below.

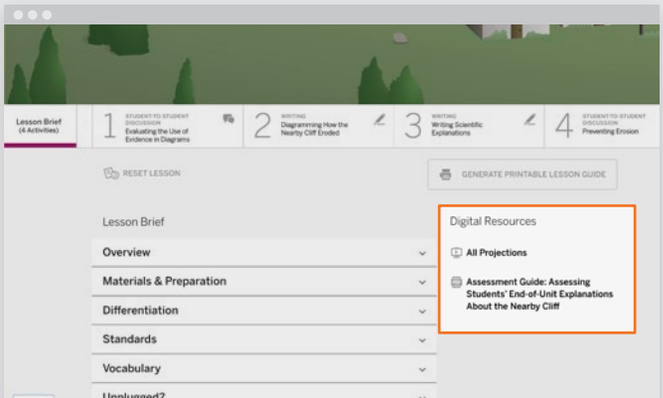
Question: Why did the nearby cliff erode overnight?

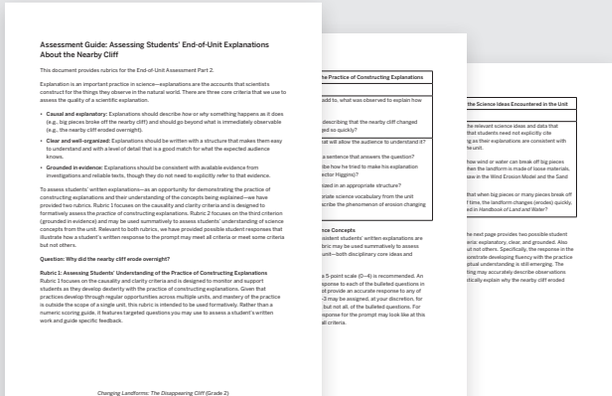
The nearby cliff eroded overnight because _____



Turn to page 79 in the *Changing Landforms* Student Investigation Notebook included in your sample.

Teachers use an Assessment Guide to assess students' explanations. The provided rubrics assess students' understanding of science practices and concepts.





A plant or animal's habitat also includes the other things that live there. Plants and animals depend on one another for the things they need.

A habitat is an example of a **system**. A system is a group of parts that affect each other. John is interested in how the parts of a habitat work together as a system.

Amplify Science

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

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UNIVERSITY OF CALIFORNIA, BERKELEY