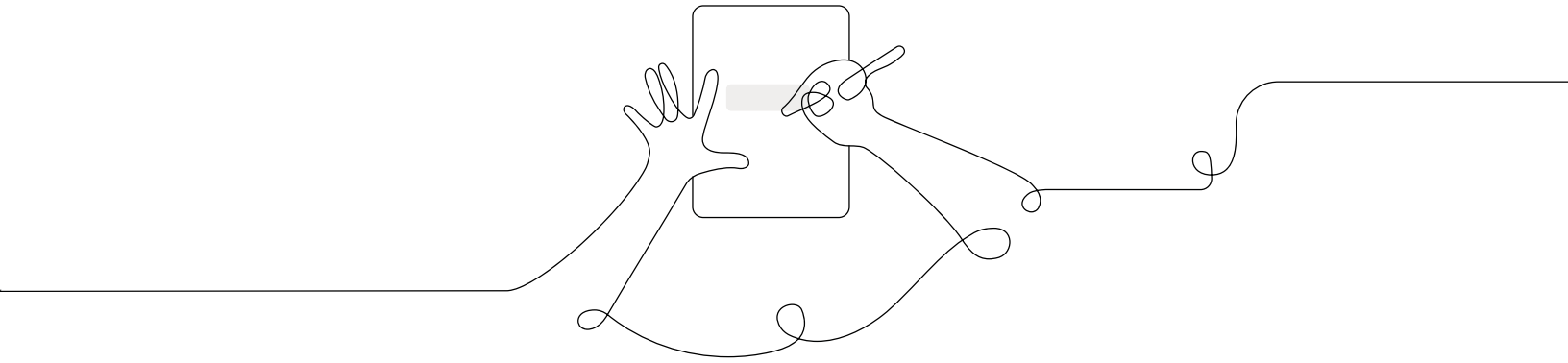
AmplifyScience

Participant Notebook

Grade 4 - Unit 3: Earth's Features
Internalization / Guided Planning



Reflection

Use the provided spaces as a place for reflection throughout the session.

Session goals and student outcomes

What	Why	How

Year at a glance

Units per year

K–2 **3**

3–5 **4**

Unit types

Although every Amplify Science unit provides a three-dimensional learning experience, each unit emphasizes one of the following specific science and engineering practices.

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 provide extra support to students engaging 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.

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 provide extra support to students engaging in the practice of argumentation. As students move up the K–5 grades, they focus on important aspects of argumentation in an intentional sequence.

Course structure

Key

- (A) Argumentation
- (E) Engineering design
- (I) Investigation
- (M) Modeling

Kindergarten (66 lessons)

- *Needs of Plants and Animals* **22 lessons** (I)
- *Pushes and Pulls* **22 lessons** (E)
- *Sunlight and Weather* **22 lessons** (M)

Grade 1 (66 lessons)

- *Animal and Plant Defenses* **22 lessons** (M)
- *Light and Sound* **22 lessons** (E)
- *Spinning Earth* **22 lessons** (I)

Grade 2 (66 lessons)

- *Plant and Animal Relationships* **22 lessons** (I)
- *Properties of Materials* **22 lessons** (E)
- *Changing Landforms* **22 lessons** (M)

Grade 3 (88 lessons)

- *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 (88 lessons)

- *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 (92 lessons)

- *Patterns of Earth and Sky* **22 lessons** (I)
- *Modeling Matter* **22 lessons** (M)
- *The Earth System* **26 lessons** (E)
- *Ecosystem Restoration* **22 lessons** (A)

K-5 Program components

The K-5 program contains both physical and digital instructional materials. The table below describes materials and, when applicable, includes links to find additional information.

Teacher materials

Teacher's Guide	Contains all of the unit's lesson plans, differentiation strategies, and an assortment of instructional supports and resources at the unit, lesson, and individual activity level (also available in print for purchase): bit.ly/amplifyk5navigation
Classroom Slides	Each lesson has a downloadable and editable PowerPoint or Google Slides file to help guide teachers and students through the lesson: bit.ly/amplifyslideshowto
Classroom Wall materials	The printed Classroom Wall materials can be found in the unit kit. PDFs are also provided in the digital Teacher's Guide: bit.ly/amplifyclassroomwall
Embedded assessments	Includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information: bit.ly/amplifyk5assessment
Program Guide	A resource for finding out more about the program's structure, components, supports, how it meets the standards, and flexibility: bit.ly/amplifyprogramguide
Program Hub	Features remote learning resources, training videos, hands-on investigation videos, and Professional Learning resources: bit.ly/amplifyprogramhub

Student materials

Hands-on materials	The unit kit includes both consumable and non-consumable physical materials used for the hands-on activities that are carried out at strategic points throughout the unit. bit.ly/amplifymaterials
Investigation Notebooks	Contains instructions for student activities and space for students to record data, reflect on ideas from texts and investigations, and construct explanations and arguments: bit.ly/amplifyk5fillable
Student books	Informational texts written by the Lawrence Hall of Science allow students to practice reading within the science content area: bit.ly/amplifystudentbooks
Digital applications	Digital tools and simulations, available across grades 2–5, support and advance learning objectives by giving students opportunities to analyze data, visualize phenomena, and share their thinking: bit.ly/amplifydigitaltools

Curriculum add-ons

Spanish-language licenses	Spanish materials that mirror their English counterparts in both content and quality are also available for purchase: bit.ly/amplifyspanish
Interactive Classroom	A new digital interface for teachers and students designed for classrooms in which every student has a digital device: bit.ly/amplifyinteractiveclassroom

Three dimensional learning reference

3-D learning engages students in using scientific and engineering practices and applying crosscutting concepts as tools to develop understanding of and solve challenging problems related to disciplinary core ideas.

Science and Engineering Practices

1. **Asking Questions and Defining Problems**
2. **Developing and Using Models**
3. **Planning and Carrying Out Investigations**
4. **Analyzing and Interpreting Data**
5. **Using Mathematics and Computational Thinking**
6. **Constructing Explanations and Designing Solutions**
7. **Engaging in Argument from Evidence**
8. **Obtaining, Evaluating, and Communicating Information**

Disciplinary Core Ideas

Earth and Space Sciences:
- Earth's Place in the Universe
- Earth's Systems
- Earth and Human Activity

Life Sciences:
- From Molecules to Organisms
- Ecosystems
- Heredity
- Biological Evolution

Physical Sciences:
- Matter and its Interactions
- Motion and Stability
- Energy and their Applications

Engineering, Technology and the Applications of Science:
- Engineering Design
- Links among Engineering Technology, Science and Society

Crosscutting Concepts

1. **Patterns**
2. **Cause and Effect**
3. **Scale, Proportion, and Quantity**
4. **Systems and System Models**
5. **Energy and Matter**
6. **Structure and Function**
7. **Stability and Change**

Scientific and Engineering Practices

NGSS@NSTA
STEM STARTS HERE

1. Asking questions (for science)
   and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science)
   and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Disciplinary Core Ideas

NGSS@NSTA
STEM STARTS HERE

Life Science	Physical Science
LS1: From Molecules to Organisms: Structures and Processes LS2: Ecosystems: Interactions, Energy, and Dynamics LS3: Heredity: Inheritance and Variation of Traits LS4: Biological Evolution: Unity and Diversity	PS1: Matter and Its Interactions PS2: Motion and Stability: Forces and Interactions PS3: Energy PS4: Waves and Their Applications in Technologies for Information Transfer
Earth & Space Science	**Engineering & Technology**
ESS1: Earth's Place in the Universe ESS2: Earth's Systems ESS3: Earth and Human Activity	ETS1: Engineering Design ETS2: Links Among Engineering, Technology, Science, and Society

Core and Component Ideas

NGSS@NSTA STEM STARTS HERE

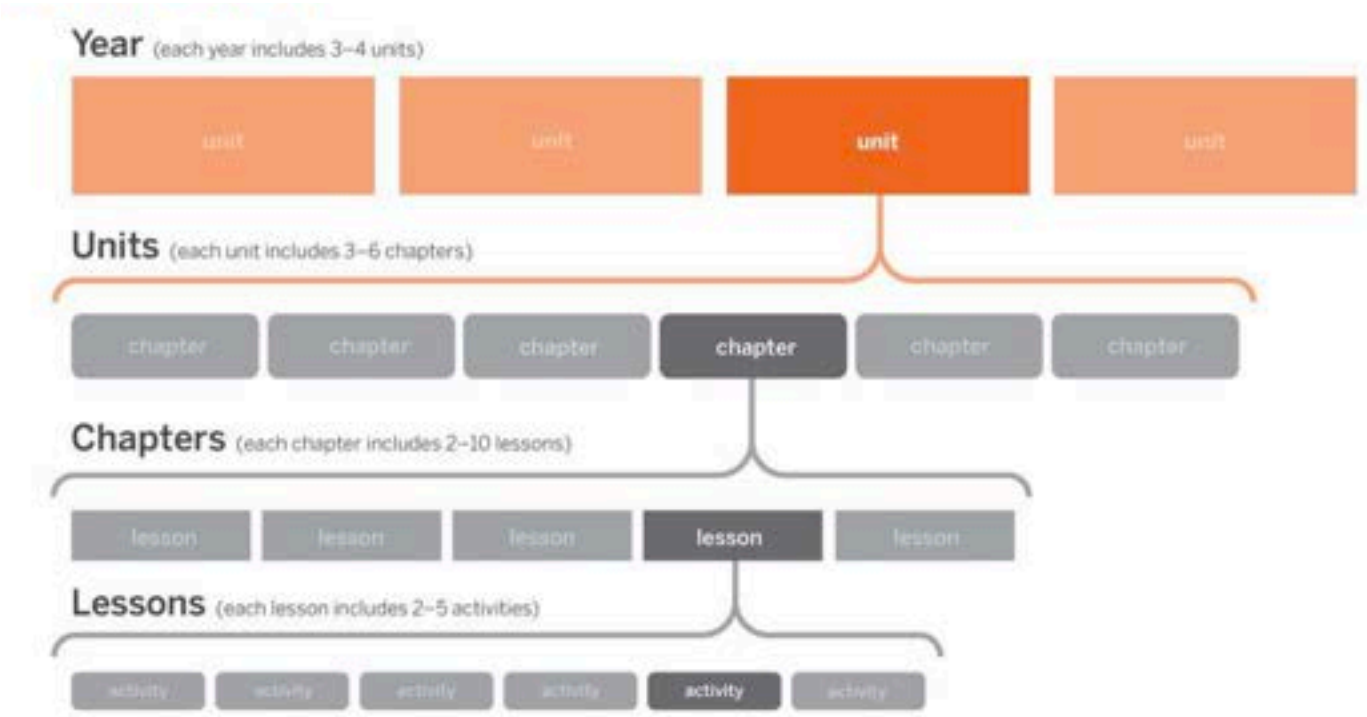
Life Science	Earth & Space Science	Physical Science	Engineering & Technology
LS1: From Molecules to Organisms: Structures and Processes LS1.A: Structure and Function LS1.B: Growth and Development of Organisms LS1.C: Organization for Matter and Energy Flow in Organisms LS1.D: Information Processing **LS2: Ecosystems: Interactions, Energy, and Dynamics** LS2.A: Interdependent Relationships in Ecosystems LS2.B: Cycles of Matter and Energy Transfer in Ecosystems LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS2.D: Social Interactions and Group Behavior **LS3: Heredity: Inheritance and Variation of Traits** LS3.A: Inheritance of Traits LS3.B: Variation of Traits **LS4: Biological Evolution: Unity and Diversity** LS4.A: Evidence of Common Ancestry and Diversity LS4.B: Natural Selection LS4.C: Adaptation LS4.D: Biodiversity and Humans	**ESS1: Earth's Place in the Universe** ESS1.A: The Universe and Its Stars ESS1.B: Earth and the Solar System ESS1.C: The History of Planet Earth **ESS2: Earth's Systems** ESS2.A: Earth Materials and Systems ESS2.B: Plate Tectonics and Large-Scale System Interactions ESS2.C: The Roles of Water in Earth's Surface Processes ESS2.D: Weather and Climate ESS2.E: Biogeology **ESS3: Earth and Human Activity** ESS3.A: Natural Resources ESS3.B: Natural Hazards ESS3.C: Human Impacts on Earth Systems ESS3.D: Global Climate Change	**PS1: Matter and Its Interactions** PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions PS1.C: Nuclear Processes **PS2: Motion and Stability: Forces and Interactions** PS2.A: Forces and Motion PS2.B: Types of Interactions PS2.C: Stability and Instability in Physical Systems **PS3: Energy** PS3.A: Definitions of Energy PS3.B: Conservation of Energy and Energy Transfer PS3.C: Relationship Between Energy and Forces PS3.D: Energy in Chemical Processes and Everyday Life **PS4: Waves and Their Applications in Technologies for Information Transfer** PS4.A: Wave Properties PS4.B: Electromagnetic Radiation PS4.C: Information Technologies and Instrumentation	**ETS1: Engineering Design** ETS1.A: Defining and Delimiting an Engineering Problem ETS1.B: Developing Possible Solutions ETS1.C: Optimizing the Design Solution **ETS2: Links Among Engineering, Technology, Science, and Society** ETS2.A: Interdependence of Science, Engineering, and Technology ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World ***Note**: In NGSS, the core ideas for Engineering, Technology, and the Application of Science are integrated with the Life Science, Earth & Space Science, and Physical Science core ideas*

Crosscutting Concepts

NGSS@NSTA
STEM STARTS HERE

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

K-5 Navigation structure



Unit Level resources

The Unit Level resources aim to quickly familiarize teachers with the unit's content, structure, and materials. It is recommended that teachers read through the Planning for the Unit documents, and consult the Teacher References as necessary. Some of the Unit Level resources include:

Planning for the Unit

Unit Overview	Describes what's in each unit and how students learn across chapters
Unit Map	An overview of what students figure out by chapter and how they figure it out
Progress Build	Explains the learning progression of ideas students figure out in the unit
Materials and Preparation	Lists materials included in the unit's kit, items to be provided by the teacher, and briefly outlines preparation requirements for each lesson
Science Background	Adult-level primer on the science content students figure out in the unit

Teacher References

Lesson Overview Compilation	Lesson Overview of each lesson in the unit, including lesson summary, activity purposes, and timing
3-D Statements	Describes 3-D learning across the unit, chapters, and in individual lessons
Assessment System	Describes components of the Amplify Science Assessment System
Embedded Formative Assessments	Includes full text of formative assessments in the unit
Books in This Unit	K-5: Summarizes each unit text and explains how the text supports instruction
Articles in This Unit	6-8: Summarizes each unit text and explains how the text supports instruction
Apps in This Unit	2-8: Outlines functionality of digital tools and how students use them

Printable Resources

Coherence Flowcharts	Visualization of how all of the different parts of a chapter connect and flow into one another so that students are able to figure out the unit phenomenon
Investigation Notebook	Digital version of the Investigation Notebook, for copying and projecting. The PDFs are fillable, so students can also complete their work digitally.
Article Compilation	6-8: Downloadable PDF with all of the unit's science articles in one document
Copymaster Compilation	Downloadable PDF with all of the unit's copymasters in one place
Print Materials	A digital copy of the Print Materials included in the Unit Kit

Unit Map

What was the environment of this place like in the past?

Playing the role of geologists, students help the director of Desert Rocks National Park explain how and when a particular fossil formed and how it came to be in its current location. Students figure out what the environment of the park was like in the past and why it has so many visible rock layers.

Chapter 1: How did the fossil get inside the rocky outcrop?

Students figure out: A fossil is the preserved remains of an organism that lived a long time ago. Fossils begin to form when the organism dies, and sediments sink through the water to completely cover its body. More and more sediment continues to build up over the body, compacting the sediment that was already there. That sediment cements and becomes rock. This process gradually makes a thicker and thicker rock layer. Parts of the organism are preserved in this rock layer.

How they figure it out: Students gather evidence from fossils and rocks, read *Clues from the Past*, and use the *Earth's Features* Simulation to explain how fossils and rock form. They apply what they learned to create a model of the process of sedimentary rock formation. Finally, they construct an argument about what Desert Rocks National Park was like in the past.

Chapter 2: What was the environment of Desert Rocks National Park like in the past?

Students figure out: The environment was a floodplain when the lower rock layer formed and a deep ocean when the upper rock layer formed. The lower layer is made of siltstone and contains a *Lepidodendron* fossil. This is evidence that the environment was a floodplain because siltstone can form in floodplains and *Lepidodendron* lived in watery areas with a lot of plants. The upper layer is made of mudstone, and a *Mosasaurus* fossil was found in this rock layer. This is evidence that it was a deep ocean because mudstone can form in a deep ocean and a *Mosasaurus* was a large animal that swam in deep water.

How they figure it out: Students use digital and physical models to investigate how fossils and rock can be used to make inferences about past environments. They gather and analyze data from informational texts and observations as well as diagrams of an area to engage in arguments about what the area was like in the past.

Chapter 3: What is the order of the past environments of Desert Rocks National Park?

Students figure out: The siltstone layer is below the mudstone layer, which is below the shale layer. Lower rock layers form first, and new rock layers form on top of them, so lower rock layers are older than the layers above them. This means that the siltstone layer formed first, then the mudstone layer, and then the shale layer. Therefore, the environment was a floodplain first, then a deep ocean, and then a shallow ocean.

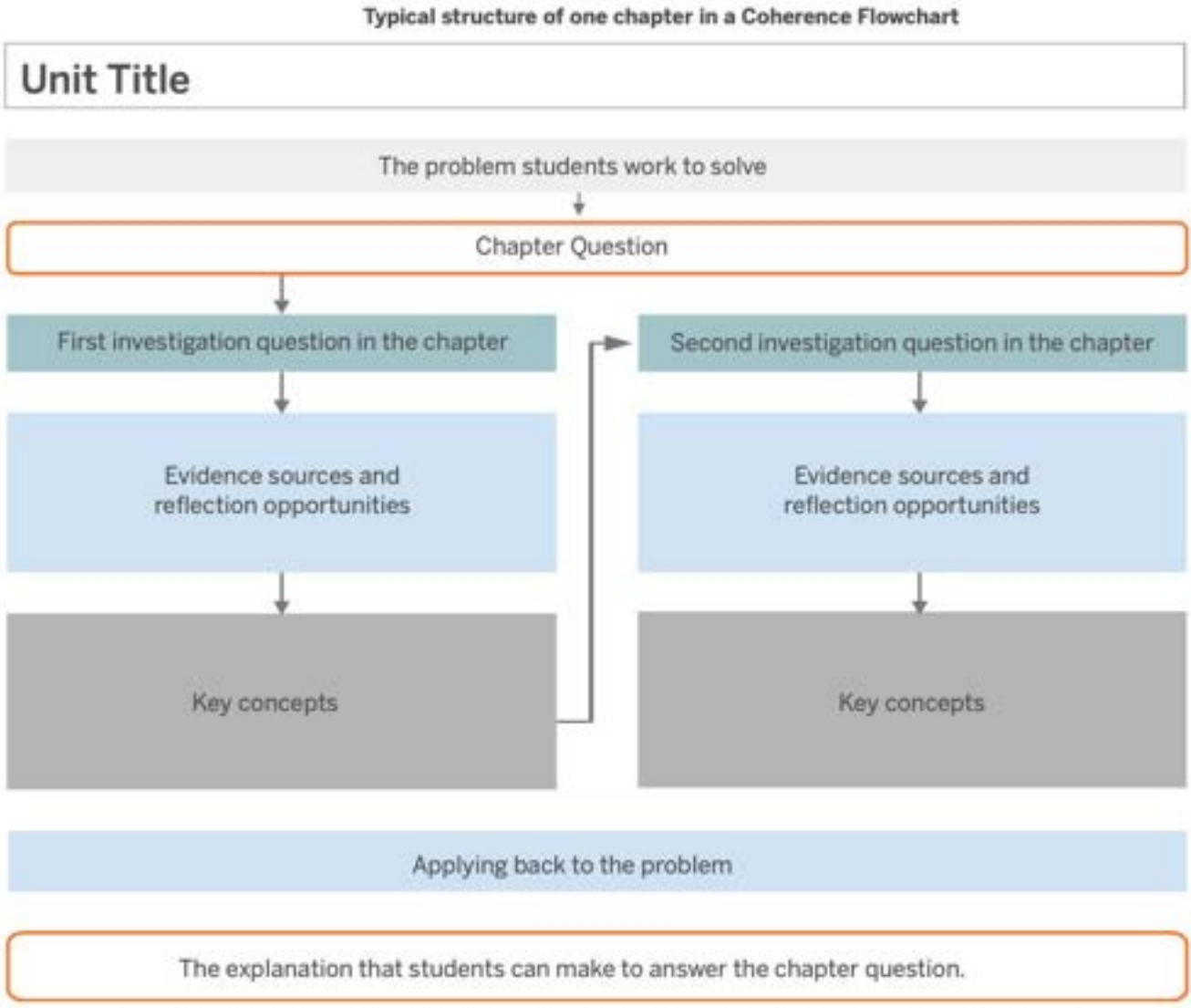
How they figure it out: Students use physical and digital models as well as analogies to discover that the lowest rock layers formed first. They obtain information from text and a digital model about which types of rock tend to form in particular environments, and they use this information to make an evidence-based argument about the order of past environments in Desert Rocks Canyon.

Chapter 4: Why did more rock layers get exposed in Desert Rocks Canyon than in Keller's Canyon?

Students figure out: More rock layers got exposed in Desert Rocks Canyon because its river is faster and has been there longer than the river in Keller's Canyon. Water can erode rock. The longer the time period that a river flows, the more the rock will erode, and a faster river can erode more rock than a river that flows slowly. Based on evidence about the speed and age of the river in Desert Rocks Canyon, this river eroded more rock because it has been flowing over the rock for a longer time and at a faster speed.

How they figure it out: Students plan and carry out investigations of the effects of water eroding rock using a model of a river as well as the Simulation. They observe that both the speed of the water and the flow of water over time affect how a rock formation can look. Students analyze evidence from models, maps, diagrams, and text to construct an argument that explains the factors that can cause more erosion in a canyon.

Coherence Flowchart structure



Instruction is framed by questions about the unit's anchor phenomenon and the related problem students are solving. Chapter Questions then guide students in figuring out the phenomenon, piece by piece. Within each chapter, Investigation Questions focus students on a manageable piece of content that will help them figure out the Chapter Question. Each question motivates activities, and each activity provides specific evidence related to the Investigation Question. Students synthesize the understanding constructed over multiple activities, and this understanding is formalized through key concepts. Often a key concept leads students to an additional Investigation Question students need to pursue to answer the Chapter Question. At the end of the chapter, students' new understanding is applied back to the unit's anchor phenomenon and leads students to a new Chapter Question or a final explanation.

Earth's Features: Mystery in Desert Rocks Canyon

Unit Anchor Phenomenon

Problem students work to solve

A rocky outcrop in Desert Rocks National Park has rock layers and a fossil in it.
What was the environment of Desert Rocks National Park like in the past?

Chapter-level Anchor Phenomenon
Chapter 1 Question

A rocky outcrop in Desert Rocks National Park has a fossil in it
How did the fossil get inside the rocky outcrop?

Investigation Questions

How do fossils form? (1.2-1.3)
(Note: See Lesson Overviews for lesson-level Investigative Phenomena)

How does sedimentary rock form? (1.4-1.5)
(Note: See Lesson Overviews for lesson-level Investigative Phenomena)

Evidence sources and reflection opportunities

- Discuss initial ideas about rocks and fossils, add them to the Rocks and Fossils Anticipatory Chart (1.1)
- Read *Clues from the Past* (1.2)
- Observe fossils (1.3)
- Use the Sim to investigate how fossils form (1.3)

- Observe conglomerate rock samples (1.4)
- Use the Sim to investigate how sedimentary rock forms (1.4)
- Revisit *Clues from the Past* to obtain information about how sedimentary rock forms (1.5)
- Develop student sedimentary rock formation models (1.5)
- Discuss and evaluate the class sedimentary rock formation model (1.5)
- Revisit the Rocks and Fossils Anticipatory Chart to reflect on new ideas (1.5)

Key concepts

- A fossil forms when an organism dies and is covered with sediment that turns into rock. (1.3)

- A sedimentary rock layer forms when sediment sinks and builds up in water, compacts under more sediment, and cements over time. (1.5)
- Over time, a rock layer becomes thicker as sediment continues to build up. (1.5)

Application of key concepts to problem

- Make a model to help answer the Chapter 1 Question (1.6)

Explanation that students can make to answer the Chapter 1 Question

The fossil is the preserved remains of an organism that lived a long time ago. The fossil formed when the organism died and sediments sank through the water and completely covered its body. More and more sediment continued to build up over the body. As more sediment landed on top, it compacted the sediment that was already there. That sediment cemented and became rock. This process gradually made a thicker and thicker rock layer. Parts of the organism became preserved in this rock layer.

Classroom Slides reference

Classroom Slides are a resource designed to make planning and teaching with Amplify Science faster and easier. Each lesson has editable slides optimized for **Microsoft PowerPoint Version 16 and Google** to help guide teachers and their students through the lesson with easy-to-follow images, videos, questions, and instructions.

This reference sheet has basic information to get you started. For a more in-depth how-to? Go to: https://tinyurl.com/amplifyslideshowto

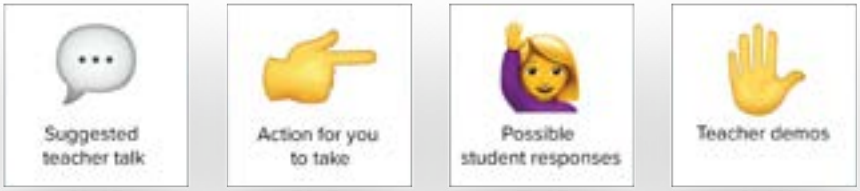
Helpful tips:

The text on the slides is color coded! Black text on the slides denotes suggested teacher talk. Orange text on the slides denotes a student action.

Icons on the slide cue the teacher about what is happening in the lesson. Here's what the icons on the slides mean:

You may occasionally also come across the following student action icons:

In addition to the text and visuals on the slide, each slide's notes field contains additional information, including possible student responses, follow-up prompts, and instructional steps. In most cases, the content on the slide is meant to come before the actions and suggested teacher talk written in the notes. Here's what the icons in the notes field mean:



Unit level internalization notes

Lesson level internalization notes

Additional Amplify resources

Program Guide

Additional insight into the program's structure, intent, philosophies, supports, and flexibility.

https://my.amplify.com/programguide

California Edition:
http://amplify.com/science/california/review

Louisiana Edition:
https://my.amplify.com/programguide/content/louisiana/welcome/elementary-school/

Amplify Help

Frequently updated compilation of articles with advice and answers from the Amplify team.

my.amplify.com/help

Caregivers Site

https://amplify.com/amplify-science-family-resource-intro/

Amplify Support

Contact the Amplify support team for information specific to enrollment and rosters, technical support, materials and kits, and teaching support, weekdays 7AM-10PM EST and weekends 10AM-6PM EST.

Email: help@amplify.com

Email: edsupport@amplify.com (pedagogical questions)

Phone: 800-823-1969

Or, reach Amplify Chat by clicking the  icon at the bottom right of the digital Teacher's Guide.

When contacting the support team:

- Identify yourself as an Amplify Science user.
- Note the unit you are teaching.
- Note the type of device you are using (Chromebook, iPad, Windows, laptop).
- Note the web browser you are using (Chrome or Safari).
- Include a screenshot of the problem, if possible. Copy your district or site IT contact on emails.

Amplify Science