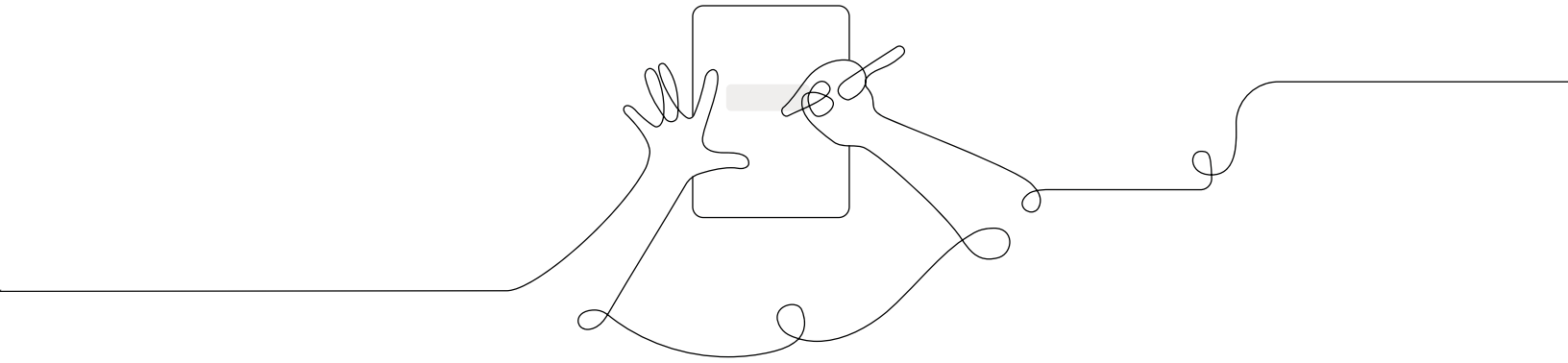
AmplifyScience

Participant Notebook

Grade 5 - Unit 3: The Earth System
Internalization / Guided Planning



Reflection

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

Session goals and student outcomes

What	Why	How

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

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

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*

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)

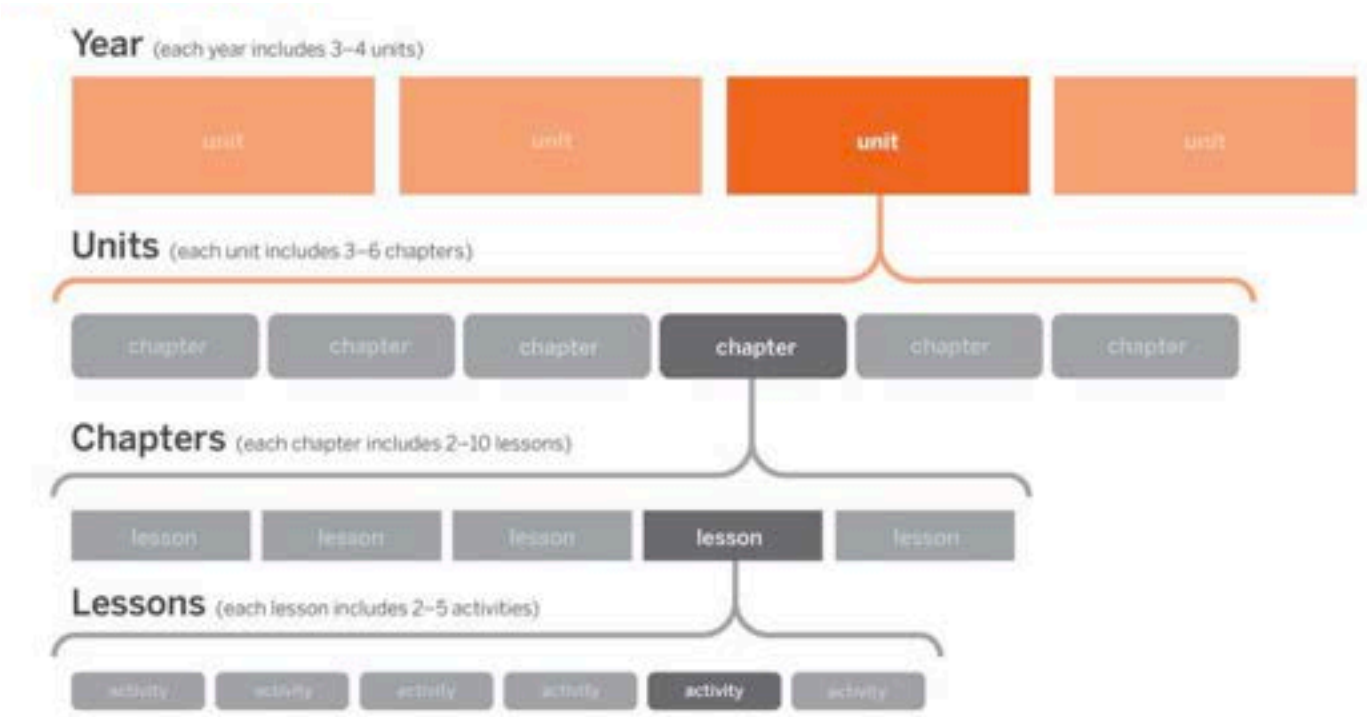
Grade 4 (88 lessons)

- *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 Navigation structure



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

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 can determine how much water is available for human use?

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 so they can help figure out what is causing the water shortage on one part of the island. They also design ways to alleviate the effects of water shortages, including freshwater collection systems and proposals for using chemical reactions to treat wastewater.

Chapter 1: Why is East Ferris running out of water while West Ferris is not?

Students figure out: Ferris Island is surrounded by ocean, but salt water is unusable for most human purposes. East Ferris's growing population is using up their only freshwater source, a groundwater reservoir, whereas West Ferris has an additional source of freshwater—rain.

How they figure it out: Students define the problem in East Ferris by analyzing graphs of global water distribution and reading about water shortages. They discuss how the biosphere and hydrosphere interact and write a scientific explanation about why East Ferris is experiencing a water shortage.

Chapter 2: Why does more rain form over West Ferris than East Ferris?

Students figure out: More rain forms over West Ferris because more water vapor condenses there. During condensation, water vapor gets colder and turns into liquid water. There is a lot of water getting cold in West Ferris, so a lot of rain forms. There is not a lot of rain forming over East Ferris, so there is not a lot of water vapor getting colder and condensing into liquid water there.

How they figure it out: Students gather information from hands-on investigations, *The Earth System* Simulation, and texts that help them understand condensation and evaporation at two scales: the observable and the nanoscopic. They apply this to a discussion of how the atmosphere and hydrosphere interact. They also design and build freshwater collection systems.

Chapter 3: Why is more water vapor getting cold over West Ferris than East Ferris?

Students figure out: There is more water vapor getting cold over West Ferris because on that side of the island more water vapor moves upward in the atmosphere where it is colder. This means that more water vapor can condense and fall as rain.

How they figure it out: Students synthesize information from text, physical models, and the Simulation to determine that at higher elevations in the atmosphere where it is colder, water vapor can condense. They also evaluate and iterate on their freshwater collection system designs.

Chapter 4: Why is there more water vapor high up over West Ferris than East Ferris?

Students figure out: More water vapor moves up in the atmosphere over West Ferris because a mountain directs the wind blowing from the ocean upward. This causes water vapor in the air to cool, condense, and fall as rain over West Ferris. Air that continues on over the mountain does not have enough water vapor left to condense and fall as rain over East Ferris.

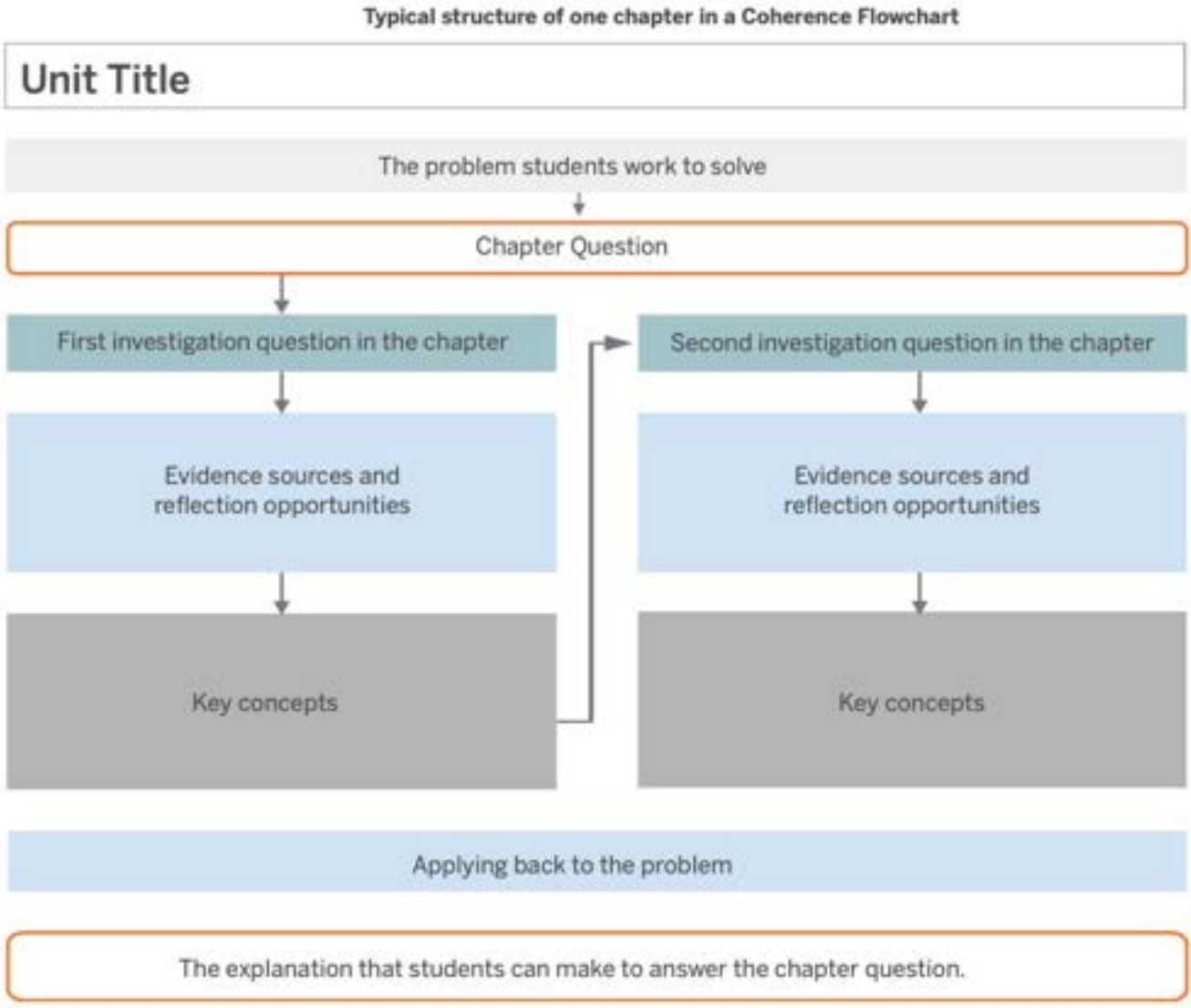
How they figure it out: Students investigate using the Simulation and a hands-on activity to observe that water vapor gets directed upward when it blows toward a mountain. They synthesize this with their knowledge of where and why water vapor condenses in order to explain how Earth system interactions create rain shadows. They also iterate once more on their freshwater collection system designs.

Chapter 5: How can East Ferris turn wastewater into clean freshwater?

Students figure out: East Ferris can add substances to wastewater that react with harmful substances in the water. The reaction creates new substances that are easier to remove from the water, so East Ferris can get clean freshwater.

How they figure it out: Students observe a chemical reaction and read about everyday chemical reactions. They use a digital model to discover that matter is not created or destroyed in chemical reactions. They write a scientific explanation about how wastewater treatment, using chemical reactions, could be another solution to the water shortage in East Ferris.

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.

The Earth System: Investigating Water Shortages

Unit Anchor Phenomenon

Problem students work to solve

West Ferris has more freshwater than East Ferris.
Why does West Ferris have more freshwater than East Ferris?

Chapter-level Anchor Phenomenon

Chapter 1 Question

East Ferris doesn't have enough water.
Why is East Ferris running out of water while West Ferris is not?

Investigation Questions

Where is water on Earth? (1.1)
(Note: See Lesson Overviews for lesson-level Investigative Phenomena)

How can people affect how much freshwater is available? (1.2-1.3)
(Note: See Lesson Overviews for lesson-level Investigative Phenomena)

Evidence sources and reflection opportunities

- Investigate how much water there is on Earth through a globe tossing activity (1.1)
- Analyze graphs of global water distribution in Water Encyclopedia (1.1)

- Discuss how people use fresh water in their daily lives (1.2)
- Read *Water Shortages, Water Solutions* (1.2)
- Observe videos of of water flowing in and out of a reservoir at different rates (1.3)

Key concepts

- Almost all of Earth's water is salt water in the ocean. The limited amount of freshwater is mostly in glaciers and groundwater. (1.1)

- The amount of available freshwater decreases when people use more than the amount that flows into their area. (1.3)

Application of key concepts to the problem

- Analyze data about precipitation and population in East Ferris (1.3)
- In pairs, create diagrams showing why East Ferris is running out of water while West Ferris is not (1.3)
- Write a scientific explanation to answer the Chapter 1 Question (1.3)

Explanation that students can make to answer the Chapter 1 Question

Ferris Island is surrounded by ocean, but salt water is unusable for most human purposes. East Ferris's growing population is using up their only freshwater source, a groundwater reservoir, whereas West Ferris has an additional source of freshwater—rain.

Unit level internalization notes

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

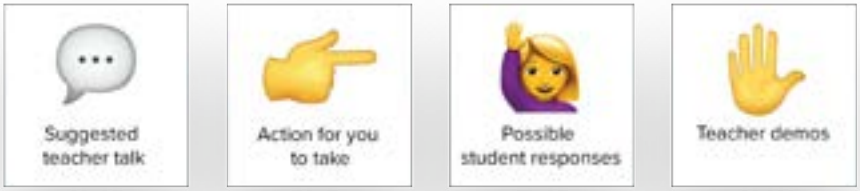
Helpful tips:

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:



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