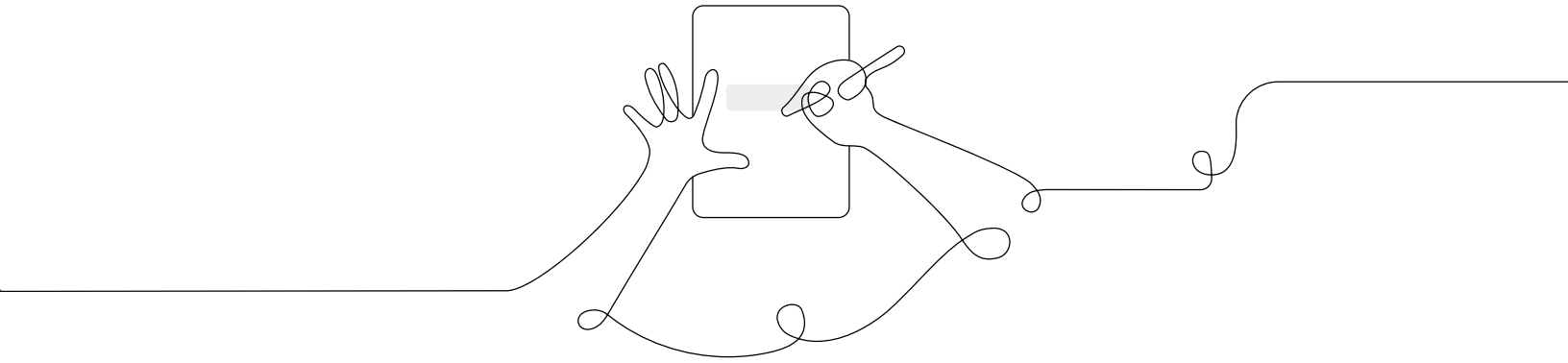
AmplifyScience

Participant Notebook

Grade 5: The Earth System
Unpacking the Phenomenon



Unit Guide resources

Once a unit is selected, select **JUMP DOWN TO UNIT GUIDE** in order to access all unit-level resources in an Amplify Science unit.

Planning for the unit

Unit Overview	Describes what's in each unit, the rationale, and how students learn across chapters
Unit Map	Provides an overview of what students figure out in each chapter, and how they figure it out
Progress Build	Explains the learning progression of ideas students figure out in the unit
Getting Ready to Teach	Provides tips for effectively preparing to teach and teaching the unit in your classroom
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
Standards at a Glance	Lists Next Generation Science Standards (NGSS) (Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts), Common Core State Standards for English Language Arts, and Common Core State Standards for Mathematics

Teacher references

Lesson Overview Compilation	Lesson Overview of each lesson in the unit, including lesson summary, activity purposes, and timing
Standards and Goals	Lists NGSS (Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts) and CCSS (English Language Arts and Mathematics) in the unit, explains how the standards are reached
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, identifies each 3-D assessment opportunity in the unit
Embedded Formative Assessments	Includes full text of formative assessments in the unit
Books in This Unit	Summarizes each unit text and explains how the text supports instruction
Apps in This Unit	Outlines functionality of digital tools and how students use them (in grades 2-5)

Printable resources

Copymaster Compilation	Compilation of all copymasters for the teacher to print and copy throughout the unit
Investigation Notebook	Digital version of the Investigation Notebook, for copying and projecting
Multi-Language Glossary	Glossary of unit vocabulary in multiple languages
Print Materials (8.5" x 11")	Digital compilation of printed cards (i.e. vocabulary cards, student card sets) provided in the kit
Print Materials (11" x 17")	Digital compilation of printed Unit Question, Chapter Questions, and Key Concepts provided in the kit

Progress Build

A Progress Build describes the way in which students' explanations of the central phenomenon should develop and deepen over the course of a unit. It is an important tool in understanding the design of the unit and in supporting students' learning. A Progress Build organizes the sequence of instruction, defines the focus of the assessments, and grounds inferences about students' understanding of the content, specifically at each of the Critical Juncture Assessments found throughout the unit. A Critical Juncture Assessment guides the instruction designed to address specific gaps in students' understanding. This document will serve as an overview of *The Earth System* Progress Build. Since the Progress Build is an increasingly complex yet integrated explanation, we represent it below by including the new ideas for each level in bold.

In *The Earth System* unit, students learn to construct scientific explanations that explain why one city on the fictional Ferris Island gets much more rain than the other city, drawing on the concepts described in the Progress Build below. Extending upon the Progress Build concepts, students are also introduced to foundational ideas about chemical reactions in Chapter 5, and they apply those ideas to investigate solutions to the water shortage problem in East Ferris. Specifically, students learn that substances change into other substances with different properties in chemical reactions, but matter is not created or destroyed. They also learn that engineers can control the results of a chemical reaction by choosing which substances to combine and that people can design solutions to protect Earth's resources.

Prior knowledge (preconceptions): Students are expected to have experienced rain and to have seen beaded water on a cold cup or dew on surfaces after a cold night, though they are not expected to link these phenomena to the condensation of water vapor. From the *Modeling Matter* unit or a similar unit about the particulate nature of matter, students are expected to have learned that matter is made of particles too small to see individually. While not necessary for students to participate fully in the unit, having exposure to these ideas will prepare students for what they will be learning.

Progress Build Level 1: Rain can happen when water vapor gets cold and condenses into liquid water.

When water molecules are spread apart, they are water vapor. When enough water vapor gets cold, the water molecules move close together and form liquid water. This is condensation. When enough liquid water condenses from water vapor, rain can happen.

Progress Build Level 2: Water vapor condenses as it moves higher, to where the atmosphere is colder.

When water molecules are spread apart, they are water vapor. When enough water vapor gets cold, the water molecules move close together and form liquid water. This is condensation. When enough liquid water condenses from water vapor, rain can happen. **The atmosphere is colder higher up. Water molecules move close together and form liquid water high up in the atmosphere because that is where it is cold. This is what causes water to condense from vapor to liquid.**

Progress Build Level 3: Mountains can redirect water vapor higher in the atmosphere.

When water molecules are spread apart, they are water vapor. When enough water vapor gets cold, the water molecules move close together and form liquid water. This is condensation. When enough liquid water condenses from water vapor, rain can happen. The atmosphere is colder higher up. Water molecules move close together and form liquid water high up in the atmosphere because that is where it is cold. This is what causes water to condense from

vapor to liquid. **The wind can move water vapor to other places in the atmosphere. When the wind is blowing toward a mountain, the mountain can change the direction of the wind to direct the air upward. This causes the water vapor, which is part of the air, to move upward to where the atmosphere is colder.**

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.

Applying conceptual understanding to explain the phenomenon

Use ideas from the Progress Build and Unit Map to make notes about the conceptual and explanatory builds in your unit.

	Science concepts	Explanation of the phenomenon
	Students figure out…	*So they can explain…*
Chapter 1		
Chapter 2		
Chapter 3		
Chapter 4		
Chapter 5		

Amplify Science@Home resources reference

Use this guide to keep track of the different resources available for remote and hybrid learning.

Instructional materials: Click Remote and hybrid learning resources, then select your grade level from the dropdown menu. Select your unit.	
@Home Unit resources: These will appear when you select your unit.	
Teacher Overview	General information for teaching with @Home Units, planning information, chapter and lesson outlines
Lesson Index	Lists the original Amplify Science lessons associated with each @Home lesson, and the Investigation Notebook pages, copymasters, and print materials associated with the @Home Unit Student Sheets
Family Overview	Information to send home to families to help them support students with remote learning
Student lesson materials for @Home Units	Printable or digital lessons condensed to be about 30 minutes long. You can access compilations of all student materials for your unit, or select from individual lessons.
@Home Video resources: After selecting your grade level and unit, select the @Home Videos tab below your unit title.	
@Home Video links	Links to video lessons that include all activities from the original units. Lesson playlists are on YouTube, and they autoplay in a playlist form.
Additional remote and hybrid instructional materials: These can be accessed from the tabs below your unit title.	
Hands-on investigations support	Videos of every unit's hands-on activities (note, these videos also appear in the student lesson materials).
Read-aloud videos	Link to a YouTube playlist of read-aloud videos of all books in your unit.
Orientation and Tutorials: Click Remote and hybrid learning resources, then select your grade from the dropdown menu. Click Orientation and Tutorials. You'll not only find videos to help you use the resources, but also videos you can share with students and caregivers.	

Notes