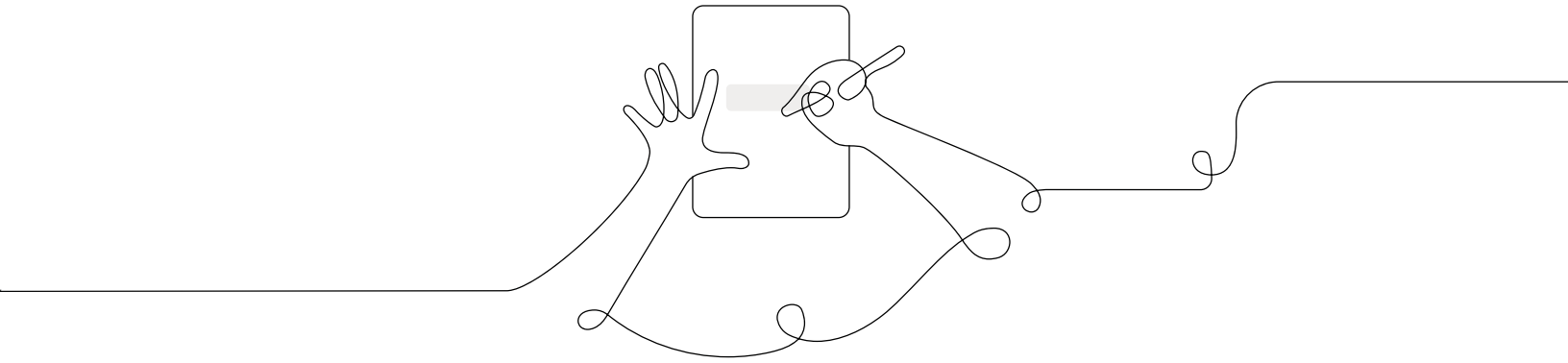
AmplifyScience

Participant Notebook

Unit Internalization and Guided Planning

Grade 7, Matter and Energy in Ecosystems



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

Unit Map

Why did the biodome ecosystem collapse?

Students examine the case of a failed biodome, an enclosed ecosystem that was meant to be self-sustaining but which ran into problems. In the role of ecologists, students discover how all the organisms in an ecosystem get the resources they need to release energy. Carbon cycles through an ecosystem due to organisms' production and use of energy storage molecules. Students build an understanding of this cycling—including the role of photosynthesis—as they solve the mystery of the biodome collapse.

Chapter 1: Why didn't the plants and animals in the biodome have enough energy storage molecules?

Students figure out: Producers make all of the energy-storage molecules for an ecosystem through the process of photosynthesis, using carbon dioxide from abiotic matter. The organisms in the biodome did not have enough energy-storage molecules because there was not enough carbon in abiotic matter.

How they figure it out: They read articles about photosynthesis. They investigate photosynthesis, energy-storage molecules, and carbon in the Sim. They view a video of a photosynthesis experiment. They analyze data about the biodome and model their ideas about its collapse.

Chapter 2: What caused carbon dioxide to decrease in the air (abiotic matter) of the biodome?

Students figure out: As organisms release energy during cellular respiration, carbon dioxide is produced from the carbon in energy-storage molecules. This process moves carbon from biotic to abiotic matter. Carbon dioxide in the biodome decreased because decomposers decreased, which means there was a decrease in cellular respiration overall.

How they figure it out: They get evidence from the Sim and from a video of an experiment to determine which organisms do cellular respiration. They read a short article about decomposers and dead matter. They model more complete ideas about the biodome collapse, using evidence about decomposers and dead matter.

Chapter 3: What happened to the carbon that used to be in the air (abiotic matter) of the biodome?

Students figure out: Since carbon cannot be produced or used up, the total amount of carbon in a closed ecosystem does not change. The decrease in carbon in the abiotic matter and in living things in the biodome means there was an increase somewhere in the system—in this case, in dead matter that had failed to decompose.

How they figure it out: They read about carbon dioxide in the whole Earth system. They use a game-like physical model to investigate carbon cycling. Students create a visual model and write their final explanation of the biodome collapse.

Chapter 4: Students apply what they learn to a new question—Why does deforestation lead to increased carbon dioxide in the air?

Deforestation, with large areas of forest being replaced with grass and livestock, is leading to more carbon dioxide in the air, and warming of the Earth's climate. Students investigate whether this is primarily due to a decrease in photosynthesis or an increase in cellular respiration. They engage in oral argumentation in a student-led discourse routine called a Science Seminar and then write final arguments.

Progress Build

Each Amplify Science Middle School unit is structured around a unit-specific learning progression, which we call the Progress Build. The unit's Progress Build describes the way students' explanatory understanding of the unit's focal phenomena is likely to develop and deepen over the course of a unit. It is an important tool in understanding the structure of a unit and in supporting students' learning: it organizes the sequence of instruction (generally, each level of the Progress Build corresponds to a chapter), defines the focus of assessments, and grounds the inferences about student learning progress that guide suggested instructional adjustments and differentiation. By aligning instruction and assessment to the Progress Build (and therefore to each other), evidence about how student understanding is developing may be used during the course of the unit to support students and modify instruction in an informed way.

The *Matter and Energy in Ecosystems* Progress Build consists of three levels of science understanding. To support a growth model for student learning progress, each level encompasses all of the ideas of prior levels and represents an explanatory account of unit phenomena, with the sophistication of that account increasing as the levels increase. At each level, students add new ideas and integrate them into a progressively deeper understanding about how matter and energy flow in an ecosystem. Since the Progress Build reflects an increasingly complex yet integrated explanation, we represent it by including the new ideas for each level in bold.

Prior knowledge (preconceptions). Middle School students will come into this unit with a general understanding that animals eat plants or other animals in order to survive; and that organisms can be generally grouped into plants, animals that eat plants, and animals that eat animals. Students who have first completed the *Populations and Resources* unit will know that organisms get energy by consuming energy storage molecules from their resource populations. This idea is also reviewed at the beginning of the *Matter and Energy in Ecosystems* unit. Students who have first completed the *Metabolism* unit will have learned that organisms release energy from energy storage molecules (such as glucose) through cellular respiration though they are unlikely to have explored how this affects the movement of matter in an ecosystem. While some students may be familiar with the idea that "matter cannot be created or destroyed," they are unlikely to have considered how matter is continually moving through a system. The *Matter and Energy in Ecosystems* Progress Build and unit structure are designed to build upon and refine this experience and prior knowledge.

Progress Build Level 1: Producers make energy storage molecules using the carbon from carbon dioxide.

Energy storage molecules are made by producers through photosynthesis. In photosynthesis, energy from the sun is used to make energy storage molecules using the carbon from carbon dioxide. This process moves carbon from abiotic matter to biotic matter. The amount of energy storage molecules available to supply the energy needs for an ecosystem depends on the amount of sunlight and carbon dioxide available to producers.

Progress Build Level 2: All organisms give off carbon dioxide when they release energy from energy storage molecules.

Energy storage molecules are made by producers through photosynthesis. In photosynthesis, energy from the sun is used to make energy storage molecules using the carbon from carbon dioxide. This process moves carbon from abiotic matter to biotic matter. The amount of energy storage molecules available to supply the energy needs for an ecosystem depends on the amount of sunlight and carbon dioxide available to producers. **Through the process of cellular respiration, producers, consumers, and decomposers release energy from energy storage molecules and make**

carbon dioxide using the carbon in energy storage molecules. When organisms give off carbon dioxide, this moves carbon from biotic matter to abiotic matter. This makes carbon available (in the form of carbon dioxide) to producers for photosynthesis.

Progress Build Level 3: Carbon cannot be produced or used up, so in a closed ecosystem there is a fixed amount.

Energy storage molecules are made by producers through photosynthesis. In photosynthesis, energy from the sun is used to make energy storage molecules using the carbon from carbon dioxide. This process moves carbon from abiotic matter to biotic matter. The amount of energy storage molecules available to supply the energy needs for an ecosystem depends on the amount of sunlight and carbon dioxide available to producers. Through the process of cellular respiration, producers, consumers, and decomposers release energy from energy storage molecules and make carbon dioxide using the carbon in energy storage molecules. When organisms give off carbon dioxide, this moves carbon from biotic matter to abiotic matter. This makes carbon available (in the form of carbon dioxide) to producers for photosynthesis. **Carbon cannot be produced or used up. Therefore, the total amount of carbon in a closed ecosystem is always the same. This means a change in the amount of carbon in abiotic matter also means the amount of carbon in biotic matter has changed, and vice versa. A change in the distribution of carbon in the ecosystem indicates that the movement of carbon (via photosynthesis or cellular respiration) has changed in the ecosystem.**

Guided Unit Internalization Planner

Unit-level internalization

Unit title:

What is the phenomenon students are investigating in your unit?	
Unit Question:	**Student role:**
By the end of the unit, students figure out ...	
What science ideas do students need to figure out in order to explain the phenomenon?	

Unit Guide Document

Unit Map

Lesson Overview Compilation

Progress Buld

Guided Unit Internalization

Part 1: Unit-level internalization

Unit title: Matter and Energy in Ecosystems

What is the phenomenon students are investigating in your unit?

There is a failed biodome, or closed ecosystem, that couldn't provide the organisms inside with the resources needed to release energy.

Unit Question:
How do all the organisms in an ecosystem get the resources they need to release energy?

Student role:
Student ecologists

By the end of the unit, students figure out ...

Students discover that a decrease in the amount of carbon in abiotic matter inherently means an increase in the amount of carbon in another part of the ecosystem. In the case of the biodome, as the amount of carbon in the air decreased, the amount of carbon in dead matter increased due to the absence of decomposers.

What science ideas do students need to figure out in order to explain the phenomenon?

Producers make energy storage molecules using the carbon from carbon dioxide. Through the process of cellular respiration, producers, consumers, and decomposers release energy from energy storage molecules and make carbon dioxide using the carbon in energy storage molecules. When organisms give off carbon dioxide, this moves carbon from biotic matter to abiotic matter, which makes carbon available to producers of photosynthesis. A change in the distribution of carbon in the ecosystem indicates that the movement of carbon (via photosynthesis or cellular respiration) has changed in the ecosystem.

Multi-day planning, including planning for differentiation and evidence of student work

<table>
<tr><td colspan="4">Day _____</td></tr>
<tr><td colspan="2">Minutes for science: _____

Instructional format:
☐ Asynchronous
☐ Synchronous</td><td colspan="2">Minutes for science: _____

Instructional format:
☐ Asynchronous
☐ Synchronous</td></tr>
<tr><td colspan="2">Lesson or part of lesson:

Mode of instruction:
❏ Preview
❏ Review
❏ Teach full lesson live
❏ Teach using synchronous suggestions
❏ Students work independently using:
❏ @Home Packet
❏ @Home Slides and @Home Student Sheets
❏ @Home Videos</td><td colspan="2">Lesson or part of lesson:

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❏ @Home Videos</td></tr>
<tr><td>Students will...</td><td>Teacher will...</td><td>Students will...</td><td>Teacher will...</td></tr>
</table>

Look at the *Students will* columns. What are students working in the lesson(s) that you could collect, review, or provide feedback on?
See Some Types of Written Work in Amplify Science to the right for guidance.

If there isn't a work product listed above, do you want to add one? Make notes below.

Some Types of Written Work in Amplify Science

- Daily written reflections
- Homework tasks
- Investigation notebook pages
- Written explanations (typically at the end of Chapter)
- Diagrams
- Recording pages for Sim uses, investigations, etc

How will students submit this work product to you?
See the Completing and Submitting Written Work tables to the right for guidance on how students can complete and submit work.

Completing Written Work	**Submitting Written Work**
• Plain paper and pencil (videos include prompts for setup) • (6-8) Student platform • Investigation Notebook • Record video or audio file describing work/answering prompt • Teacher-created digital format (Google Classroom, etc)	• Take a picture with a smartphone and email or text to teacher • Through teacher-created digital format • During in-school time (hybrid model) or lunch/materials pick-up times • (6-8) Hand-in button on student platform

How will you differentiate this lesson for diverse learners? (Navigate to the lesson level on the standard Amplify Science platform and click on differentiation in the left menu.)

Day _____

Minutes for science: _____

Instructional format:

☐ Asynchronous
☐ Synchronous

Lesson or part of lesson:

Mode of instruction:

- ❏ Preview
- ❏ Review
- ❏ Teach full lesson live
- ❏ Teach using synchronous suggestions
- ❏ Students work independently using:
  - ❏ @Home Packet
  - ❏ @Home Slides and @Home Student Sheets
  - ❏ @Home Videos

Students will…	Teacher will…

Minutes for science: _____

Instructional format:

☐ Asynchronous
☐ Synchronous

Lesson or part of lesson:

Mode of instruction:

- ❏ Preview
- ❏ Review
- ❏ Teach full lesson live
- ❏ Teach using synchronous suggestions
- ❏ Students work independently using:
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  - ❏ @Home Slides and @Home Student Sheets
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How will you differentiate this lesson for diverse learners? (Navigate to the lesson level on the standard Amplify Science platform and click on differentiation in the left menu.)

Suggestions for synchronous time

The following are some ideas for making the most of synchronous time with your students. As a general rule, the best way to use your synchronous time is to provide students opportunities to talk to one another, or to observe or visualize things they could not do independently.

Online synchronous time	Notes
Online discussions: It's worthwhile to establish norms and routines for online discussions in science to ensure equity of voice, turn-taking, etc. **Digital tool demonstrations:** You can share your screen and demonstrate, or invite your students to share their screen and think-aloud as they use a Simulation or other digital tool. **Interactive read-alouds**: Screen share a digital book or article, and pause to ask questions and invite discussion as you would in the classroom. **Shared Writing:** This is a great opportunity for a collaborative document that all your students can contribute to. **Co-constructed class charts:** You can create digital charts, or create physical charts in your home with student input.	

Chapters at a Glance

Unit Question

How do all the organisms in an ecosystem get the resources they need to release energy?

Chapter 1: Photosynthesis

Chapter Question

Why didn't the plants and animals in the biodome have enough energy storage molecules?

Investigation Questions

- Where do the energy storage molecules in an ecosystem come from? (1.2, 1.3, 1.4)
- What factors affect how many energy storage molecules producers are able to make? (1.5, 1.6)

Key Concepts

- Carbon is part of carbon dioxide, which is abiotic matter. Carbon is also part of energy storage molecules, which are biotic matter. (1.4, 1.5) ?
- During the process of photosynthesis, producers make energy storage molecules, using carbon from carbon dioxide and energy from sunlight. This moves carbon from abiotic to biotic matter. (1.4) ?
- If one part of a system changes, this affects the rest of the system. (1.5) ?
- When there is more carbon (in the form of carbon dioxide) in abiotic matter, more carbon is available to producers for making energy storage molecules. (1.6) ?
- When there is less carbon (in the form of carbon dioxide) in abiotic matter, less carbon is available to producers for making energy storage molecules. (1.6)
- When there is more sunlight, producers can ?make more energy storage molecules from the carbon in carbon dioxide. (1.6) ?
- When there is less sunlight, producers cannot make as many energy storage molecules from the carbon in carbon dioxide. (1.6)

Chapter 2: Cellular Respiration in Ecosystems

Chapter Question

What caused carbon dioxide to decrease in the air (abiotic matter) of the biodome?

Investigation Questions

- Where does the carbon dioxide in abiotic matter come from? (2.1) ?
- How do organisms give off carbon dioxide? (2.2)

Key Concepts

- As organisms release energy during cellular respiration, carbon dioxide is produced from the carbon in energy storage molecules. This process moves carbon from biotic to abiotic matter. (2.3)

Chapter 3: Carbon Movement in Ecosystems

Chapter Question

What happened to the carbon that used to be in the air (abiotic matter) of the biodome?

Investigation Questions

- If the amount of carbon changed in one part of a closed ecosystem, what happened to the carbon in the rest of the ecosystem? (3.1, 3.2)

Key Concepts

- Since carbon cannot be produced or used up, the total amount of carbon in a closed ecosystem does not change. (3.3) ?
- If the amount of carbon increased in abiotic matter, then it also decreased in biotic matter. If the amount of carbon decreased in abiotic matter, then it also increased in biotic matter. (3.3)

Chapter 4: Science Seminar

Chapter Question

Why does deforestation lead to increased carbon dioxide in the air?

Matter and Energy in Ecosystems unit vocabulary

abiotic matter (1.2)
biotic matter (1.2)
ecosystem (1.2)
energy storage molecule (1.2)
system (1.2)
consumer (1.3)
producer (1.3)
carbon (1.4)
carbon dioxide (1.4)
photosynthesis (1.4)
cellular respiration (2.2)
decomposer (2.2)
connect (2.3)

Adapting the Amplify Science Approach for Remote Learning

In Amplify Science units, students figure out phenomena by using science and engineering practices. They gather evidence from multiple sources and make explanations and arguments through multiple modalities: doing, talking, reading, writing, and visualizing. They also make their learning visible by posting key concepts on the classroom wall. While we have retained this core approach in the @Home Lessons, enacting it at home will require adaptations.

The @Home Lessons provide general guidance for these adaptations, but you may need to set up expectations for specific routines or provide additional support to your students. Below are ideas for how different aspects of the Amplify Science approach might be adapted for your learners' particular contexts.

Student talk options

- Talk to a member of their household about their ideas.
- Call a friend or classmate and discuss their ideas.
- Talk in breakout groups in a video class meeting.
- Use asynchronous discussion options on technology platforms.

Student writing options

- Write in a designated science notebook.
- Photograph writing and submit digitally.
- Complete prompts in another format. (Teachers can convert prompts so they are completed in an on-line survey or an editable document so students can submit digitally.)
- Submit audio or video responses digitally, rather than submit a written response.
- Share a response orally with a family member or friend with no submission required.
- For students with technology access, complete written work in the students' Amplify accounts (links to corresponding student activities are provided in the @Home Slides).

Student reading options

- Read printed version of article, included with @Home Packets. (Note: although the articles are originally in color, they are provided in the @Home Packets in grayscale for ease of copying. Most articles translate well into grayscale but there will be some exceptions).

- Read printed or PDF version of article, included with @Home Student Sheets.
- Listen to the article being read aloud using the audio feature in the Amplify Science Library or read articles in digital format via the Amplify Science Library (links are provided in the @Home Slides).
- Read with a partner, classmate, or someone from their home.

Hands-on activity options

- Do the activity with simple materials students are likely to have at home. (For activities where this is feasible, instructions are provided.)
- Watch a video. (For some hands-on activities in the @Home Units, a video / images of the investigation are provided.)
- Do the activity using kit materials if available. For example,
    - If possible, send home materials to students who need them.
    - If you have access to your Amplify Science kit, and have opportunities to teach synchronously, demonstrate some hands-on activities with student input.

Classroom wall options

The classroom wall, which provides an important reference for students to track and reflect on their developing understanding of the unit's anchor phenomenon and content, has been reimagined as an @Home Science Wall. A complete list of Chapter Questions, key concepts, and vocabulary that have been introduced so far are provided in the last lesson of each chapter. To enhance students' experience of the @Home Science Wall, you could have students:

- Draw a picture or write their ideas on their @Home Science Wall pages.
- Highlight each question, key concept, or word that is introduced.
- Cut out each question, key concept, or word. These can be then posted on a wall, large sheet of paper, or refrigerator at home.

Additionally, if you are meeting with your class remotely, you could create a virtual @Home Science Wall.

Adaptations of other Amplify Science routines

- **Reading support.** In Amplify Science 6–8, support for student reading includes: teacher modeling; structured paired and whole group discussion of texts; multiple readings of text; an audio feature in the Amplify Library; as well as suggestions for additional

strategies for students who need more reading support. Some suggestions to offer similar supports with the @Home Lessons are:

    - Meet virtually as a class or in small groups and read the first part of the article with students, modeling how you would read the text.
    - Ask student pairs to meet after reading to discuss their annotations.
    - Have each student meet with someone in their home to read at least some of the text together and/or discuss their annotations after reading.

- **Talk routines.** In Amplify Science units students periodically talk in small groups using routines such as Word Relationships and Write and Share. You may consider including and adapting these routines by having students meet and talk to their peers in small groups or asking each student to conduct the routine with someone in their home.

- **Science Seminar.** Each core unit in Amplify Science 6–8 culminates with a Science Seminar, which is a whole-class, student-led argumentation routine. An adapted version of the Science Seminar has been included in the @Home Units. Some suggestions for implementing this are:
    - Hold your Science Seminar in class, if you are meeting in person some of the time.
    - Hold Seminars with your whole class, remotely. Students can participate all at the same time, or you might break the group up in thirds or in half and have the students who are not talking take notes using the Science Seminar Observations sheet.
    - Hold Seminars with pairs or small groups meeting on the phone, on video calls, or in virtual breakout rooms.
    - Have students talk to someone in their household about the Science Seminar evidence and claims.

@Home Units assessment considerations

Each Chapter Outline contains considerations for assessment and feedback in the Amplify Science units, and in some cases, the pre-unit and end-of-unit assessments. Generally, we recommend the following:

- You may need to adapt the format in which you collect student work. See the “Student writing options” above.

- When providing feedback to students, you may wish to focus on how students are attending to the Investigation and/or the Chapter Questions, if they are using evidence they have gathered to support their responses to questions, and if they are using appropriate unit vocabulary in their responses.

@Home Units guidance for synchronous and in-person learning

Each @Home Lesson contains suggestions for using these asynchronous resources in conjunction with virtual or in-person class sessions. If you are able to choose particular lessons to conduct together with students, we recommend:

- Holding discussions to engage students in figuring out the unit phenomenon.
    - At the beginning of each chapter so students can share their initial ideas or evolving ideas about the unit phenomenon.
    - At the end of the chapter so students can talk as they make sense of evidence, and/or synthesize various sources of information, and make an explanation or argument about the phenomenon.
- If you have access to kit materials, you can conduct hands-on demonstrations when hands-on materials are unavailable to students. Solicit student input as you demonstrate.
- If students do not have access to technology at home, when in-person, you can provide time for them to make observations and discuss ideas related to the simulations and digital tools.

Notes