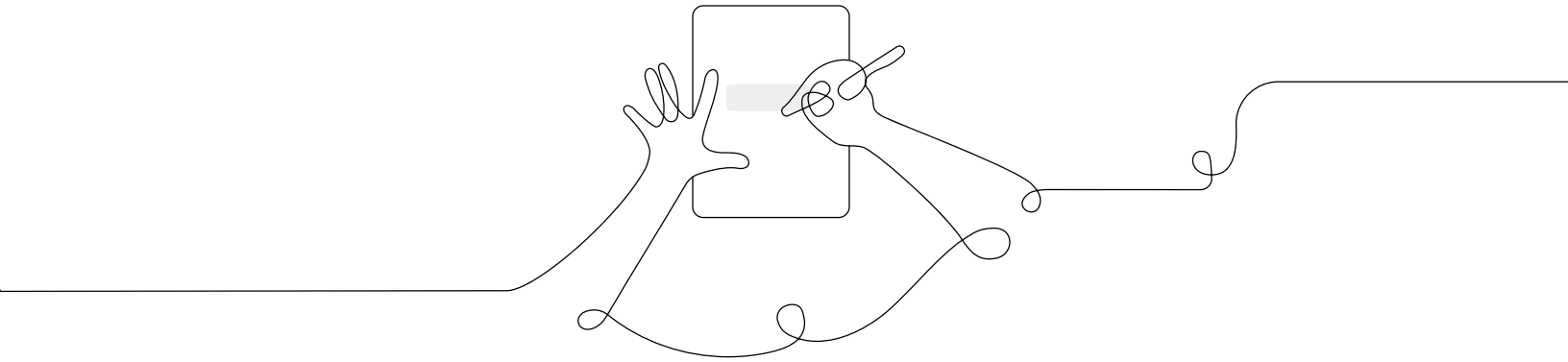
AmplifyScience

Participant Notebook

Unit Internalization and Guided Planning

Grade 7, Matter & 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 Build

Guided Unit Internalization

Part 1: Unit-level internalization

Unit title: Matter & Energy in Ecosystems

What is the phenomenon students are investigating in your unit?

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.

Unit Question:

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

Student role:

Ecologists

By the end of the unit, 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.

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. All organisms give off carbon dioxide when they release energy from energy storage molecules. Carbon cannot be produced or used up, so in a closed ecosystem there is a fixed amount.

Matter and Energy in Ecosystems @Home Lesson Index

The Amplify Science@Home Units are versions of Amplify Science units adapted for use in a remote learning or hybrid learning situation. To help you plan instruction, below we have listed the @Home Lessons alongside the Amplify Science unit's Lesson(s) from which they come.

Index: @Home Unit Lessons and corresponding *Matter and Energy in Ecosystems* Lessons

@Home Lesson	Adapted from Amplify Science *Matter and Energy in Ecosystems*
@Home Lesson 1	Lesson 1.2
@Home Lesson 2	Lesson 1.3
@Home Lesson 3	Lesson 1.4
@Home Lesson 4	Lesson 1.5 and 1.6
@Home Lesson 5	Lesson 2.1
@Home Lesson 6	Lessons 2.2
@Home Lesson 7	Lessons 2.3
@Home Lesson 8	Lesson 3.1
@Home Lesson 9	Lessons 3.2
@Home Lesson 10	Lesson 3.3
@Home Lesson 11	Lesson 3.4
@Home Lesson 12	Lesson 4.1
@Home Lesson 13	Lesson 4.2 and 4.3
@Home Lesson 14	Lesson 4.4

The student sheets and packets used in @Home units are original or modified versions of the unit's Amplify Science Investigation notebook pages or copymasters. When necessary, new pages were also created. In the following table we have outlined the @Home Student Sheet and Packet page titles and their origins.

Index: @Home Student Sheets/Packets and corresponding *Waves, Energy, and Information* materials

@Home Lesson	Student Sheet/Packet page title	Investigation Notebook page, copymaster, or print material	Possible Responses
1	Biodome Files 1 article set	Lesson 1.2 Digital resources	N/A
1	Examining the Biodome Files	Pg. 7	Lesson 1.2, Activity 2, Card 1 Possible Responses
1	Glossary	Lesson 1.2 Digital resources	N/A
2	Sunlight and Life article set	Lesson 1.3 Digital resources	N/A
3	Comparing Two Models of Photosynthesis	Modified, based on Pg. 16	Lesson 1.4, Activity 2, Card 1 Possible Responses
3	Observing Photosynthesis Close Up	Modified, based on Pgs. 15 and 17	Lesson 1.4, Activity 3, Card 1 Possible Responses
4	Modeling Energy Storage Molecules	New	N/A
4	Decreasing Energy Storage Molecules	Modified, based on Pg. 23 and 24	Lesson 1.5, Activity 3, Card 1 Possible Responses
4	Completing an Explanation to the Econauts	New	N/A
4	Chapter 1 Science Wall	New, based on Classroom Wall materials	N/A
5	Carbon Dioxide in Ecosystems	New	N/A
5	The Snail and Elodea Experiment	Modified, based on Pg. 38	Lesson 2.1, Activity 3, Possible Responses
5	A Feast for Decomposers article set	Lesson 2.1 Digital resources	N/A
6	Observing Cellular Respiration	Modified, based on Pg. 42 and 43	Lesson 2.2, Activity 2, Card 2, Possible Responses
7	Testing a Claim in the Sim	Modified, based on Pg. 49	Lesson 2.3, Activity 3,

			Possible Responses
7	Writing to the Econauts	Modified, based on Pg. 51	N/A
7	Chapter 2 Science Wall	New, based on Classroom Wall materials	N/A
8	Carbon in the Global Ecosystem article set	Lesson 3.1 Digital resources	N/A
9	Reread "Carbon in the Global Ecosystem"	Pg. 75	Lesson 3.2, Activity 2, Possible Responses
9	Carbon Game Instructions	Modified, based on Lesson 3.1 Digital resources	N/A
9	Ecosystem Game Board	New	N/A
9	Action Cards	New	N/A
9	Event Cards	New	N/A
10	Finding the Missing Carbon	Modified, based on Pg. 81 and 82	Lesson 3.3, Activity 2, Card 1, Possible Responses
10	Biodome Files 2 and 3 article sets	Lesson 3.3 Digital resources	Lesson 3.3, Activity 3, Possible Responses
11	Cause and Effect in the Biodom	New	N/A
11	Biodome Model	New	N/A
11	Chapter 3 Science Wall	New, based on Classroom Wall materials	N/A
12	Annotating and Discussing Evidence	Pg. 95	Lesson 4.1, Activity 2, Possible Responses
12	Science Seminar Evidence Cards	Modified, based on Lesson 4.1 Digital resources	N/A
12	Sorting the Evidence	Pg. 96	Lesson 4.1, Activity 4, Possible Responses
12	Science Seminar Questions and Claims	Modified, based on Lesson 4.1 Digital resources	N/A
13	Argumentation Sentence Starters	New	N/A
13	Writing a Scientific Argument	Modified, based on Pg. 107 and 108	Lesson 4.3, Activity 4, Possible Responses
14	Written-Response Question #1	Lesson 4.4 Digital resources	Lesson 4.4, Activity 2, Possible Responses

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

Day @Home Lesson 1

Minutes for science: 15 min.	**Minutes for science:** 30 min
Instructional format: ☒ Asynchronous ☐ Synchronous	**Instructional format:** ☐ Asynchronous ☒ Synchronous
Lesson or part of lesson: Introducing the biodome (slides 1-13)	**Lesson or part of lesson:** Read article set & discuss ideas
Mode of instruction: ☒ Preview ☐ Review ☐ Teach full lesson live ☐ Teach using synchronous suggestions ☒ Students work independently using: ☐ Printed @Home Slides ☒ Digital @Home Slides ☐ @Home Videos	**Mode of instruction:** ☐ Preview ☐ Review ☐ Teach full lesson live ☒ Teach using synchronous suggestions ☐ Students work independently using: ☐ Printed @Home Slides ☐ Digital @Home Slides ☐ @Home Videos
Students will... View slides and the video that introduces students to the unit. Jot down initial ideas about their reactions to the video.	**Students will...** Read from the *Biodome Files* article set, which they use to brainstorm initial ideas about the Chapter Question. Discuss their ideas from the reading and their initial ideas about why there weren't enough energy storage molecules for plants and animals in the biodome.
Teacher will... Assign slides 1-13 in Schoology and provide direction for students to jot down their ideas about the unit problem to share when the class meets together.	**Teacher will...** Lead students through the lesson activities using slides 13-28 allowing students time to collaborate as they discuss their ideas about the Chapter question

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.

Asynchronous: students jot down their initial ideas

Synchronous: record revised ideas about Chapter 1 question after peer discussion

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.

Asynchronous: students jot initial ideas on paper or digitally to bring with them to the asynchronous lesson

Synchronous: Students will use the student sheets to record their initial ideas about the Chapter 1 question

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.)

Supports:

- Provide students with the Multi-Language Glossary where appropriate
- Provide sentence starters
- Leverage primary language for discussions

Extension:

- Have students write questions about the unit phenomenon.

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

Day _____

Minutes for science: _____ **Instructional format:** ❏ Asynchronous ❏ Synchronous	**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:
  ❏ Printed @Home Slides
  ❏ Digital @Home Slides
  ❏ @Home Videos
	Lesson or part of lesson:
	
	Mode of instruction:
	❏ Preview
	❏ Review
	❏ Teach full lesson live
	❏ Teach using synchronous suggestions
	❏ Students work independently using:
	  ❏ Printed @Home Slides
	  ❏ Digital @Home Slides
	  ❏ @Home Videos

Students will...	**Teacher will...**	**Students will...**	**Teacher will...**

Look at the *Students will* columns. What are students working in the lesson(s) above 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 • (6-8) Homework tasks • (K-5) 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** • 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)	**Submitting Written Work** • 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.)		

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

Day _____

Minutes for science: _____ **Instructional format:** ❏ Asynchronous ❏ Synchronous	**Minutes for science: _____** **Instructional format:** ❏ Asynchronous ❏ Synchronous

Lesson or part of lesson:
 	
Mode of instruction:
❏ Preview
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  ❏ @Home Videos
	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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	  ❏ Digital @Home Slides
	  ❏ @Home Videos

Students will...	Teacher will...	Students will...	Teacher will...

Look at the *Students will* columns. What are students working in the lesson(s) above 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 • (6-8) Homework tasks • (K-5) 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** • 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)	**Submitting Written Work** • 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.)

@Home Teacher Overview - Chapter 1
Overview of Matter & Energy in Ecosystems @Home Lessons 1-5

@Home Lesson 1
Students watch the *Living in a Biosphere* video. Students are introduced to Unit and Chapter Questions, and to their role as ecologists who are investigating why the energy needs of the organisms in the biodome were not met. Students read from the *Biodome Files* article set, which they use to brainstorm initial ideas about the Chapter Question. Pairs of students discuss their ideas from the reading and their initial ideas about why there weren't enough energy storage molecules for plants and animals in the biodome.

@Home Lesson 2
Breakout Group 1
Students learn about photosynthesis through reading and annotating the *Sunlight and Life* article set. Students discuss their thinking about the reading in order to share important insights and surface alternative conceptions.

@Home Lesson 3
Breakout Group 2
Students examine several different types of energy storage molecules in order to learn more about what they are, how they are used, and where they come from. Students revisit the *Sunlight and Life* article set and focus on using a diagram to help them deepen their understanding of photosynthesis. Students use the Sim to get a dynamic visualization of photosynthesis at the cellular level that will help them think more about where energy storage molecules come from. Students compare the visual model from the Sim with the photosynthesis diagram from the article set and gather more evidence about where energy storage molecules come from.

@Home Lesson 4
Breakout Group 3
Students evaluate two completed models to determine which one accurately depicts where the energy storage molecules in an ecosystem come from. Students use the Sim to gather evidence for the new Investigation Question, finding out what factors can cause energy storage molecules in an ecosystem to decrease. In pairs, students discuss graphical data about the amounts of carbon dioxide, sunlight, and water in the biodome. Students complete an explanation to the Econauts, answering the Chapter 1 Question.

@Home Lesson 5
Breakout Group 4
Students are introduced to the Chapter 2 question and the new Investigation Question. Students use the Sorting Tool to make claims about what parts of the ecosystem release carbon dioxide to the atmosphere. Students make predictions and then observe a video of an experiment in order to think more about what types of organisms produce carbon dioxide. Students read the introduction to an article set about decomposers and then revise their ideas from earlier about which parts of an ecosystem give off carbon dioxide.

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.	

Questioning Strategies for Grades 6–8

Overview of the Role of Open-Ended Questioning

Repeated opportunities for students to listen to and speak with others are essential for promoting deep thinking and learning in science. Meaningful teacher-initiated questions create a rich context for promoting open-ended student dialogue and discussion. The *Science Framework for California Public Schools* explains that "Simply providing opportunities to talk is not enough. Effective questioning can scaffold student thinking" (*California Science Framework*, 2016, Chapter 11, p. 21). The Framework suggests that "Teacher-initiated questions are key to helping students expand their communication, reasoning, arguments, and representation of ideas in science" (*California Science Framework*, 2016, Chapter 11, p. 21). The types of questions that teachers pose are instrumental in supporting student understanding. The Framework calls for more open-ended teacher questioning that "prompts and facilitates students' discourse and thinking" and less teacher questioning that prompts "students to seek a confirmatory right answer" (*California Science Framework*, 2016, Chapter 11, p. 6).

The Amplify Science Teacher's Guide is infused with opportunities for students to discuss their developing ideas in response to open-ended prompts. Questions to promote student thinking and discussion are purposefully built into the Teacher's Guide instructional steps and Teacher Support notes that surround all our hands-on and reading activities. In addition, all units include discourse routines (e.g., Shared Listening, Think-Draw-Pair-Share, Write and Share, Word Relationships) that provide opportunities for students to use focal unit vocabulary as they think and talk with partners and the class about their understanding of key science content and practices. Many of the On-the-Fly Assessment suggestions provided throughout each unit offer open-ended follow-up questions that can be used to probe student thinking and formatively assess student understanding of the content. In addition, each unit includes multiple opportunities for students to respond to open-ended questions through additional modalities (e.g., in writing, with diagrams, through a kinesthetic model).

While the prompts embedded in each of the opportunities mentioned above provide fertile ground for student discussion, continued use of flexible, open-ended questions is invaluable for assessing students' knowledge and skills, promoting student-to-student discourse, and guiding student learning. A collection of grade-appropriate questions follows that can be used for these purposes. You will also find a list of activity types included within the Amplify Science curriculum that are particularly conducive to the use of these questions. You may choose to print out these questions and activity types for reference throughout your instruction.

Open-Ended Questions to Facilitate Student Thinking and Discourse

Questions to assess students' knowledge and skills:

- Can you explain how you decided that this claim is the best one?
- Can you explain why X happened?
- Would you (and your partner) explain the steps you went through (to create the model you made)?
- How do you know X?
- If XXX were changed, how would that change YYY?

Questions to promote student-to-student discourse:

- Do you agree or disagree with (that idea)? Why?
- Can you add evidence to support (student name)'s thinking?
- Do you have evidence to go against (refute) (that idea)?
- Does anyone else have something to add to the conversation?
- We are working together right now to figure out/better understand X. Can anyone start us off with some thinking about this (question, problem, idea)?
- Can you explain X, using science vocabulary words XX and YY (from the unit)?
- What claim does this evidence support? How do you know?
- Can you explain why this evidence is important?
- Can you explain why this evidence does not support Claim Y?
- How does your idea relate to what others have said today?

Questions to guide student learning:

- I hear what you are saying (or I read your question/response). Can you explain your thinking to me a bit more so I can understand your idea?
- Some students have said that they think X happened. Can those students work together to find more evidence to support this idea?
- You are claiming that Y happened/explains this phenomenon.
    - Can you find more evidence to support your claim? Please go back to these resources (e.g., simulation, article) and see if you can find more evidence.
    - Which evidence can you use to make a stronger argument?
- How can we investigate why this happened?
- What did you notice? What else do we need to figure out?

Activity Types Within the Amplify Science Curriculum That Are Especially Suited for Additional Teacher Questioning

The activity types listed below are student-centered and often contain prompts for pairs or small groups of students to use to discuss content or to vet evidence together. As you circulate through the classroom during these activities, you can use the open-ended questions to assess students' knowledge and skills, promote student-to-student discourse, and guide student learning.

- Hands-on activities
- Discourse routines (e.g., Write and Share, Word Relationships)
- Discussion after reading
- Paired Modeling Tool activities
- Paired Reasoning Tool activities
- Paired Simulation activities
- Evidence Card sorts
- Evidence Gradient card sorts
- Discussion of evidence in preparation for a Science Seminar (discussing which claim the evidence supports and why, sorting evidence in pairs)
- Science Seminar

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