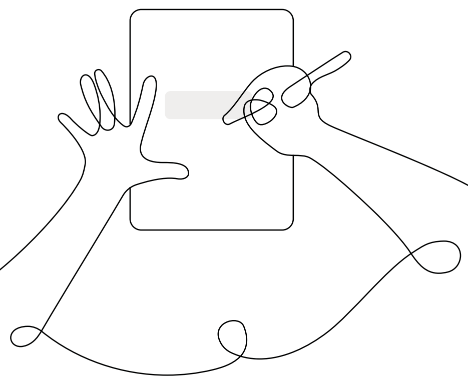
Amplify Science

Participant Notebook

Unit Internalization and Guided Planning

Grade 6, Weather Patterns



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

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Unit Map

Why have recent rainstorms in Galetown been so severe?

Weather is a complex system that affects our daily lives. Understanding how weather events, such as severe rainstorms, take place is important for students to conceptualize weather events in their own community. Students play the role of student forensic meteorologists as they discover how water vapor, temperature, energy transfer, and wind influence local weather patterns in a fictional town called Galetown. They use what they have learned to explain what may have caused rainstorms in Galetown to be unusually severe in recent years.

Chapter 1: What causes the rainfall in Galetown?

Students figure out: Rainfall is caused by motion of water and transfer of energy. When liquid water becomes warmer, it can evaporate and become water vapor in the air. All air contains water. When water vapor in an air parcel cools, it can condense into liquid water which can form a cloud and fall as rain. Energy transfers from warm air to cold air until the temperatures become equal. The more an air parcel loses energy and cools, the more rainfall can happen.

How they figure it out: They explore the *Weather Patterns* Simulation, conduct a firsthand condensation experiment and model the experiment in the Sim. They read about Dr. Joanne Simpson, a scientist who studied the formation of clouds. They create different weather events in the Sim, and create visual models of rain in Galetown before and after the creation of an artificial lake.

Chapter 2: Why is the amount of rain in Galetown different from storm to storm?

Students figure out: The amount of rain is affected by air temperature. The troposphere is warmest at the surface and coldest at its highest point. If an air parcel is warmer than the surrounding air, it will rise. As an air parcel rises, energy transfers from the warm air parcel to the cold surrounding air until the temperatures become equal. When an air parcel starts with a higher temperature, it will rise higher and lose more energy, causing more rainfall. Systems go through periods of stability and periods of change.

How they figure it out: They explore troposphere, temperature, and air parcels in the Sim. They read *Disaster in California!*, an article describing the causes of a series of massive rainstorms. They test the relationship between temperature and rainfall in the Sim. They analyze temperature data from Galetown and model their new understanding of the recent severe storms there. They review concepts with a differentiated weather card game.

Chapter 3: Why did the most recent storm in Galetown have the greatest amount of rain?

Students figure out: The amount of rain is also affected by air pressure. Air moving from areas of high pressure to areas of low pressure is wind. Air parcels can be pushed up into the troposphere by wind (moving air).

How they figure it out: They investigate the relationship between pressure, wind, and rainfall in the Sim, and view a video demonstration of how wind causes rising air. They consider the reliability of different sources of weather data and evaluate data about Galetown. They use this evidence to model their understanding of the severe storms in Galetown, and write a scientific argument supporting their claim.

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Chapter 4: Students apply what they learn to a new question—How was the Carson Wilderness Education Center damaged?

The remote Carson Wilderness Education Center has been damaged by rain. Students construct arguments about whether this was due to one severe rainstorm or several moderate rainstorms. They consider evidence about humidity (water vapor in the air), temperature, and wind. They engage in oral argumentation in a student-led discourse routine called a Science Seminar and then write final arguments.

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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 *Weather Patterns* 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 of what causes severe rainfall, and why some rainstorms have more rain than others. 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). At the start of the *Weather Patterns* unit, middle school students are likely to understand rain as part of Earth's water cycle, such that liquid water from Earth's surface evaporates and eventually falls back down to Earth as rain. However, they will most likely be largely unfamiliar with using an air parcel as a unit of air to trace the movement of air and the mechanism of energy transfer that drives the water cycle. Many students are likely to have a simplified conception of the water cycle as water from Earth's surface rising and falling back down as rain; however, they are unlikely to understand how the height that an air parcel rises to factors into determining the amount of rain because of the amount of energy transfer. These concepts are essential for students to understand why the amount of energy from the sun and the presence of wind are factors that can affect the amount of rain. Understanding this material may be especially difficult due to students' experiences with various weather events in different regions, so it becomes even more important to help students focus on the type of weather event that the unit is focused on, which is rain, and to focus on investigating factors that can cause different amounts of rain. This experience and prior knowledge can be built on and refined, which the Weather Patterns Progress Build and unit structure are designed to do.

Progress Build Level 1: Rain can happen when an air parcel cools and loses energy. The loss of energy causes water vapor in the air parcel to condense and fall as rain.

All air contains water vapor. When the temperature of an air parcel and the temperature of the surrounding air are different, energy transfer happens. Energy always transfers from warmer air to cooler air until the temperatures of the two become equal. So, when an air parcel is warmer than the air that surrounds it, energy flows from the warm air parcel to its cooler surrounding air until the temperature of the air parcel becomes equal to the temperature of the surrounding air. When an air parcel cools down and loses energy, the water vapor in the air parcel condenses into liquid water and can fall as rain. The more an air parcel loses energy and cools, the more rainfall can happen.

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Progress Build Level 2: A warmer air parcel has more energy, so it can rise higher into the troposphere and lose more energy, which can result in a greater amount of rain.

All air contains water vapor. When the temperature of an air parcel and the temperature of the surrounding air are different, energy transfer happens. Energy always transfers from warmer air to cooler air until the temperatures of the two become equal. So, when an air parcel is warmer than the air that surrounds it, energy flows from the warm air parcel to its cooler surrounding air until the temperature of the air parcel becomes equal to the temperature of the surrounding air. When an air parcel cools down and loses energy, the water vapor in the air parcel condenses into liquid water and can fall as rain. The more an air parcel loses energy and cools, the more rainfall can happen. **An air parcel at the surface becomes warmer when the sun heats the surface of Earth, and that energy transfers from the surface of Earth to the air above, warming the air parcel at the surface. The warm air parcel rises into the troposphere where it gets colder with altitude. As the warm air parcel rises higher in the colder troposphere, it loses energy until the air parcel's temperature becomes equal to the temperature of its surrounding air in the troposphere. Since the surrounding air in the troposphere becomes colder higher up, the temperature of the air parcel will drop more as it rises higher until it reaches the same temperature as its surrounding air. This will cause the air parcel to lose more energy and result in more rainfall.**

Progress Build Level 3: Wind can push an air parcel higher into the troposphere causing the air parcel to lose more energy, which can result in a greater amount of rain.

All air contains water vapor. When the temperature of an air parcel and the temperature of the surrounding air are different, energy transfer happens. Energy always transfers from warmer air to cooler air until the temperatures of the two become equal. So, when an air parcel is warmer than the air that surrounds it, energy flows from the warm air parcel to its cooler surrounding air until the temperature of the air parcel becomes equal to the temperature of the surrounding air. When an air parcel cools down and loses energy, the water vapor in the air parcel condenses into liquid water and can fall as rain. The more an air parcel loses energy and cools, the more rainfall can happen. An air parcel at the surface becomes warmer when the sun heats the surface of Earth, and that energy transfers from the surface of Earth to the air above, warming the air parcel at the surface. The warm air parcel rises into the troposphere where it gets colder with altitude. As the warm air parcel rises higher in the colder troposphere, it loses energy until the air parcel's temperature becomes equal to the temperature of its surrounding air in the troposphere. Since the surrounding air in the troposphere becomes colder higher up, the temperature of the air parcel will drop more as it rises higher until it reaches the same temperature as its surrounding air. This will cause the air parcel to lose more energy and result in more rainfall. **Wind pushing an air parcel higher in the troposphere can also cause the air parcel to rise higher and lose more energy. Wind is air moving from areas of high pressure to areas of low pressure. When an air parcel at the surface is in an area with low pressure and is surrounded by areas of high pressure, wind blows toward the air parcel which can push the air parcel higher in the troposphere where it is colder. This causes the air parcel to cool more and lose more energy, resulting in more rainfall.**

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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

Unit Map

Progress Buld

Guided Unit Internalization

Part 1: Unit-level internalization

Unit title: Weather Patterns

What is the phenomenon students are investigating in your unit?

Why have rain storms in Galetown been unusually severe in recent years?

Unit Question:	**Student role:**
Why do some rain storms have more rain than others?	Student forensic meteorologists

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

Rainfall is caused by motion of water and transfer of energy. The amount of rain is affected by air temperature and air pressure. The troposphere is warmest at the surface and coldest at its highest point. If an air parcel is warmer than the surrounding air, it will rise. As an air parcel rises, energy transfers from the warm air parcel to the cold surrounding air until the temperatures become equal. When an air parcel starts with a higher temperature, it will rise higher and lose more energy, causing more rainfall. Systems go through periods of stability and periods of change. Air moving from areas of high pressure to areas of low pressure is wind. Air parcels can be pushed up into the troposphere by wind.

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

Rain can happen when an air parcel cools and loses energy. The loss of energy causes water vapor in the air parcel to condense and fall as rain. A warmer air parcel has more energy, so it can rise higher into the troposphere and lose more energy, which can result in a greater amount of rain. Wind can push an air parcel higher into the troposphere causing the air parcel to lose more energy, which can result in a greater amount of rain.

Weather Patterns @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 *Weather Patterns* Lessons

@Home Lesson	Adapted from Amplify Science *Weather Patterns*
@Home Lesson 1	Lesson 1.2
@Home Lesson 2	Lesson 1.3
@Home Lesson 3	Lesson 1.4
@Home Lesson 4	Lesson 1.5
@Home Lesson 5	Lesson 1.6
@Home Lesson 6	Lesson 2.1
@Home Lesson 7	Lesson 2.2
@Home Lesson 8	Lesson 2.3
@Home Lesson 9	Lesson 2.4
@Home Lesson 10	Lesson 3.1
@Home Lesson 11	Lesson 3.3
@Home Lesson 12	Lessons 4.1 and 4.2
@Home Lesson 13	Lesson 4.3
@Home Lesson 14	Lesson 4.4

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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 *Weather Patterns* materials

@Home Lesson	Student Sheet/Packet page title	Investigation Notebook page, copymaster, or print material	Possible Responses
1	Water Cycle in the Sim	New	N/A
1	Exploring Weather and Water at Home	Modified, based on Lesson 1.2 copymaster	Lesson 1.2, Activity 5, Possible Responses
1	*Weather Patterns* Glossary	Lesson 1.2 Digital Resource	N/A
2	Simulating Condensation	Modified from Pgs. 13–14	Lesson 1.3, Activity 3, Possible Responses
2	Temperature Conversions	Modified from Print Materials	N/A
3	Article "What Are Clouds?"	Lesson 1.4 Digital Resource	N/A
4	Making Different Weather Events	Modified from Pgs. 26–27	Lesson 1.5, Activity 3, Possible Responses
5	Word Relationships Routine Chapter 1	Modified from Pg. 31	Lesson 1.6, Activity 2, Possible Responses
5	Modeling Galetown	Modified from Pgs. 32–34	Lesson 1.6, Activity 3, Possible Responses
5	Chapter 1 @Home Science Wall	New, based on Classroom Wall materials	N/A
6	Cooling Air Parcels	Modified from Pg. 41	Lesson 2.1, Activity 2, Possible Responses
7	Article "Disaster in California!"	Lesson 2.2 Digital Resource	N/A
8	Rereading "Disaster in California!"	Pg. 50	Lesson 2.3, Activity 2, Possible Responses
8	Simulating Rainstorms	Modified from Pgs. 51–52	Lesson 2.3, Activity 3, Possible Responses
9	Word Relationships Routine	Modified from Pg. 56	Lesson 2.4, Activity 2, Possible

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	Chapter 2		Responses
9	Modeling the Effect of Temperature	Modified from Pgs. 57–60	Lesson 2.4, Activity 3, Possible Responses
9	Chapter 2 @Home Science Wall	New, based on Classroom Wall materials	N/A
10	Make Wind!	New	N/A
10	Make Two Air Parcels	Modified from Pg. 84	Lesson 3.1, Activity 3, Possible Responses
11	Modeling Severe Rainstorms in Galetown	Modified from Pgs. 94–97	Lesson 3.3, Activity 2, Possible Responses
11	Writing an Argument About Galetown's Severe Storms	Modified from Pg. 99	Lesson 3.3, Activity 4, Possible Responses
11	Chapter 3 @Home Science Wall	New, based on Classroom Wall materials	N/A
12	Map of the Carson Wilderness Education Center Area	Lesson 4.1 copymaster	N/A
12	Science Seminar Evidence Cards	Modified, based on Lesson 4.1 copymaster	N/A
12	Discussing and Organizing Evidence	Modified from Pg. 115	N/A
12	Evidence from May at the Wilderness Education Center	Pg. 116	Lesson 4.2, Activity 3, Possible Responses
13	Argumentation Sentence Starters	Print material	N/A
13	Argument Organizer	Lesson 4.3 copymaster	N/A
13	Writing a Scientific Argument	Modified, based on Lesson 4.3 copymaster	Lesson 4.3, Activity 3, Possible Responses
14	Written-Response Question #1	Lesson 4.4 End-of-Unit Assessment copymaster	Lesson 4.4, Activity 2, Possible Responses
14	Written-Response Question #2	Lesson 4.4 End-of-Unit Assessment copymaster	Lesson 4.4, Activity 3, Possible Responses

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

Day @Home Lesson 1

Minutes for science: 15 min.

Instructional format:
- [x] Asynchronous
- [ ] Synchronous

Lesson or part of lesson:

Introducing the Big Storms in Galetown (slides 1-17)

Mode of instruction:
- [x] Preview
- [ ] Review
- [ ] Teach full lesson live
- [ ] Teach using synchronous suggestions
- [x] Students work independently using:
  - [ ] Printed @Home Slides
  - [x] Digital @Home Slides
  - [ ] @Home Videos

Students will...	Teacher will...
View slides and the video that introduces students to the unit. Jot down initial ideas about their reactions to the video.	Assign slides 1-17 in Schoology and provide direction for students to jot down their ideas about the unit problem to share when the class meets together.

Minutes for science: 30 min

Instructional format:
- [ ] Asynchronous
- [x] Synchronous

Lesson or part of lesson:

Summarize the introduction to the unit, students engage with the simulation and reflect on the water cycle

Mode of instruction:
- [ ] Preview
- [ ] Review
- [ ] Teach full lesson live
- [x] Teach using synchronous suggestions
- [ ] Students work independently using:
  - [ ] Printed @Home Slides
  - [ ] Digital @Home Slides
  - [ ] @Home Videos

Students will...	Teacher will...
Discuss the claims and their initial ideas. Engage with the simulation to develop an understanding of the water cycle, then reflect on their observations. Complete the observation activity on slides 40-41 for hw.	Revisit the unit question on slide 10 and the claims on slide 15. Present slides 18-31 giving students an opportunity to engage with the simulation. Use slides 32-39 to lead a reflection conversation. Assign the final *do* activity for homework, slides 40-41.

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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 observations while engaging with the simulation and record observations as they explore weather and water for homework

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 observations while engaging with the simulation as well as their observations as they explore weather and water at home and submit through Schoology.

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.)

Supports:
- Encourage students to engage in student-to-student discussion
- Provide students with the Multi-Language Glossary where appropriate, add images
- Leverage primary language for discussions
- Teacher modeling of the simulation (could also use the video)
- Strategic partnering

Extension: Have students create a visual representation of what they learned from the simulation/discussion.

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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:
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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

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Students will…	**Teacher will…**	**Students will…**	**Teacher will…**

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@Home Teacher Overview – Chapter 1
Overview of Weather Patterns @Home Lessons 1-5

@Home Lesson 1:
- After activating prior knowledge about the water cycle, students are introduced to the unit problem and their role as student forensic meteorologists. Students use the Weather Patterns Sim, or watch a video of the Sim investigation, to investigate how the amount of surface water can affect the amount of water vapor in the air. Students reflect on the water cycle processes they observed in the Sim. With a member of their household, students observe the weather and water in their environment at home.

@Home Lesson 2:
Breakout Group 1
- Students use the Weather Patterns Sim, or watch a video of the Sim investigation, to examine the factors affecting condensation and the amount of energy transfer. Students reflect on why and when condensation happens.

@Home Lesson 3:
Breakout Group 2
- Students actively read an article ("What Are Clouds?") about cloud formation and Joanne Simpson, a pioneering meteorologist. Pairs discuss the article and their annotations.

@Home Lesson 4:
Breakout Group 3
- Students reread a section of the "What Are Clouds?" article to gather evidence about what causes an air parcel to cool. Students use the Weather Patterns Sim, or watch a video of the Sim investigation, to collect data on different weather events. Students discuss their data with a partner to draw conclusions about energy transfer and rain.

@Home Lesson 5:
Breakout Group 4
- Students engage in the Word Relationships routine where they use unit vocabulary to create sentences that help answer the Chapter 1 Question. Students review the @Home Science Wall, including the Chapter 1 Question, key concepts, and vocabulary. Students create visual models of two storms to explain their thinking about how the addition of a lake can affect rainstorms.

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.

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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?

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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

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Amplify Science@Home resources reference

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

<table>
<tr><td colspan="2">Instructional materials:
Click Remote and hybrid learning resources, then select your grade level from the dropdown menu. Select your unit.</td></tr>
<tr><td colspan="2">@Home Unit resources:
These will appear when you select your unit.</td></tr>
<tr><td>Teacher Overview</td><td>General information for teaching with @Home Units, planning information, chapter and lesson outlines</td></tr>
<tr><td>Lesson Index</td><td>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</td></tr>
<tr><td>Family Overview</td><td>Information to send home to families to help them support students with remote learning</td></tr>
<tr><td>Student lesson materials for @Home Units</td><td>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.</td></tr>
<tr><td colspan="2">@Home Video resources:
After selecting your grade level and unit, select the @Home Videos tab below your unit title.</td></tr>
<tr><td>@Home Video links</td><td>Links to video lessons that include all activities from the original units. Lesson playlists are on YouTube, and they autoplay in a playlist form.</td></tr>
<tr><td colspan="2">Additional remote and hybrid instructional materials:
These can be accessed from the tabs below your unit title.</td></tr>
<tr><td>Hands-on investigations support</td><td>Videos of every unit’s hands-on activities (note, these videos also appear in the student lesson materials).</td></tr>
<tr><td>Read-aloud videos</td><td>Link to a YouTube playlist of read-aloud videos of all books in your unit.</td></tr>
<tr><td colspan="2">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.</td></tr>
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Notes